

New Hard Disk Announced for System Two and System Three

Cromemco has just announced a new 5-megabyte hard disk that can mount inside a System Two or System Three computer. Now adding a 5-megabyte Winchester disk drive to a System Two or System Three is as easy as opening the front panel, slipping in the disk drive module, and plugging a WDI-II disk controller into an unused bus slot. Cromemco calls this new unit the model HD-5.

Although Cromemco bills the HD-5 as a 5-megabyte disk drive, the unit actually has an unformatted capacity of 6.72 megabytes. Fully configured in a CDOS or CROMIX system you still have well over 5 megabytes of user file storage. And access to those files is fast, too. The stepper motor head positioner of the drive is controlled by "smart" circuitry which is able to slew over multiple tracks, rather than step over them one at a time, for fast track access. This is particularly important in multi-user applications where differ-

ent users may be simultaneously accessing files stored in different locations on the disk.

The disk drive used in the HD-5 disk module is the same rugged drive used in the Cromemco CS1-H computer. The drive uses two 5" platters rotating at 4800 RPM in a completely sealed environment. The disks use a tough plated metal media, rather than softer metal oxide, for long trouble-free service. The system motor positioner is devoid of complex servo-tracking circuitry, again for highly reliable operation. The HD-5 module even includes its own fan to be sure that the disk drive runs cool at all times. Mean time between failures (MTBF) for the HD-5 is estimated at 10,000 hours.

Mounting the HD-5 in your system is a snap. In the System Two the HD-5 module mounts on the inside front panel beneath the floppy disk

Continued on page 10

A Universal Microcomputer Local Area Network

By David Mandelkern

When several computers are installed at one site, it is often desirable to "network" these individual computers together. This means that messages or files can be transferred from one machine to another, or that resources can be shared. A high speed printer or a high capacity mass storage device on one system, for example, could be used (with appropriate password protection) by a user on another system. Cromemco has developed a Local Area Network standard designed to meet this need. Hardware and software to support this network will be released in the latter part of 1982.

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Supercharge FORTRAN: Use an Arithmetic Processing Unit

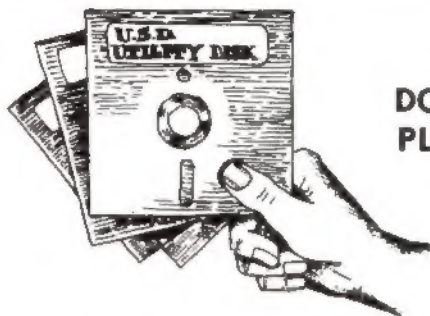
By Thomas N. Ronayne

This article is about time — the time it takes from when you hit Carriage Return until the printer starts spitting out answers to the problem you're trying to solve. No, it's not an esoteric discussion of the inner workings of the Z-80 and its support devices; rather it's a tale of the trials and tribulations I went through to cut down the amount of time it took to process an application: from over forty minutes to about four minutes. I did it by putting a supercharger on FORTRAN and, just like putting a "hurry-up" accessory on an automobile, it wasn't easy. But the

Continued on page 14



ENHANCE YOUR CROMEMCO DISK OPERATING SYSTEM WITH USD'S CDOS UTILITIES



**DON'T GET CAUGHT
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CONTENTS OF USD's CDOS UTILITY DISK

Adir

Displays an alphabetical directory of any CDOS disk, including hard disks. This program is similar to Cromemco's STAT/A, but operates up to TEN TIMES FASTER than STAT/A, especially on the hard disk. Also displays the following useful disk information: disk label, disk date, maximum directory entries, directory entries available, number of files displayed, number of file extents, file Kbyte total, and file Kbytes free. Allows printing a continuous alphabetical archival directory, which cannot be performed with Cromemco's STAT.

CLmap

Displays a cluster map of any CDOS disk, including hard disks. May be used to identify the contents of any disk cluster, or to display the cluster map of any disk file, showing the file's clusters relative to the total disk cluster map. Ambiguous file references are allowed. Identifies all directory entries, including extended (normally transparent) directory entries on hard disks. Useful for re-packing a disk for fastest operation of often-used programs.

Comline

Programmer's aid in interpreting the CDOS command line. Displays all information at default FCB-1 and FCB-2, and command line buffer. If you are programming in assembly language for CDOS or the Cromix CDOS simulator, you should not be without this program. There is never any question as to how the command line will be interpreted: what you see is what you get.

Dstat

A very fast routine to display disk status information for any CDOS diskette, or CDOS hard disk. Operates up to TEN TIMES FASTER than Cromemco's STAT or STAT/B. Displays the following information: disk FORMAT label, disk directory label, disk date, directory entries left, directory entries used, maximum disk directory entries, file space left, file space used, file space used for hard disk extended directory, and maximum disk file space. This utility is normally supplied with USD's SuperCopy I.

DT

Displays and/or sets CDOS date and time. The time function requires a hardware real time clock, such as that built into the Cromemco 3102 terminal, or any other hardware clock, with appropriate I/O software. This program is much faster than Cromemco's STAT/DT for setting and/or displaying CDOS date and time.

DumpRCD

Provides an ASCII/Hex dump of CDOS file records. Similar to Cromemco's DUMP, with the following additional enhancements: display record-at-a-time or continuous ascending display; start dump at any desired file record or address; choice of new starting record or address may be made without reloading program.

Edir

Similar to Adir, but displays only ERASED entries. This utility is normally supplied with USD's RESTORE.

Eject

Remotely eject any one diskette, or all diskettes in Cromemco's 8 inch (PerSci, Inc.) drives.

*All programs require a Cromemco computer operating under CDOS 2.36 or higher.

Pdt

CDOS I/O printer driver with perpetual calendar, for use with Cromemco's 3703 (Centronics 703) or TI-810 printers. May also be used with any "Centronics compatible" printer capable of responding to an ASCII form feed. This I/O driver will format any desired number of lines on a page and print the page number on the bottom of each page. Prevents printing over page perforations on continuous form paper. When used with a hardware clock, such as in the Cromemco 3102 terminal, may be used to print the day of the week, date, and time. Pdt.Com is an executable program which automatically installs a CDOS resident I/O driver. When used with Sdt.Com, you may instantly select between a parallel printer and a serial printer.

RAW

Turns CDOS Read-After-Write on or off. Turning RAW off can more than double the effective read/write speed of Cromemco's floppy diskettes. A viable method for increasing the speed of ASCII editors and word processors. If you want to exceed the speed of CP/M systems, but retain the advantages of Cromemco's CDOS, this program is for you.

Read

Allows rapid examination and string search of large ASCII files. Designed to be used with the Cromemco 3102 terminal, operating under CDOS. Read.Com provides forward and backward scrolling, continuous, line-at-a-time, or page-at-a-time viewing, and rapid movement forward and backward thru a file. Provides choice of ten different scroll speeds. May also be used to print an entire file, or just one screenful at a time. In the search mode, this program can locate a desired string in a 100 Kbyte file in less than five seconds! Useful applications: rapid search and examination of large ASCII data base files (e.g. telephone directories, employee data records, etc.); rapid search and examination of large ASCII source files for any programming language. Read.Com provides all of the ASCII file search and examination flexibility of a sophisticated editor or word processor but at up to 50 times the speed, with the additional advantage of small command file size (8 Kbytes), and the ability to print all or selected portions of a file. Most users of Read.Com rarely use the CDOS "TYPE" command.

Replace

Provides rapid, trouble-free search and replace of any desired ASCII string in any CDOS file. Useful for customizing or changing sign-on messages, version numbers, etc.

Sdt

Similar to Pdt, but for use with serial daisy-wheel printers such as the Diablo 1600 or Xerox 1700 series, Qume Sprint 5-9 series, or compatible NEC printers. Provides bidirectional, optimized thruput printing when using these printers as CDOS system list (LST: or PRT:) devices. As with Pdt, provides perpetual calendar and system clock printout. Requires UART serial port hardware such as Cromemco's TU-ART, or the serial port on the SCC/d single card computer.

Sector

Displays an ASCII/Hex dump of any physical or logical CDOS disk block or sector.

Speed

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Cromemco users can now have 16-megabytes of storage with Control Data Corporation's Winchester technology Lark hard disk drive. Back-up storage is provided with 8-megabytes of fixed memory and 8-megabyte removeable cartridge.

Graphics Plotter Hardpack

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The new Hewlett-Packard 7470A 2-pen plotter is a perfect complement to any Cromemco computer system. Designed with an RS-232 interface for easy connection, the "Sweet Lips" plotter is engineered with H-P excellence to perform reliably for the life of your system.

MCS MENUtility Softpack

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This Menu generator program provides a friendly, user-oriented menu system for CROMIX¹ users. Any desired set of application programs may be selected from an automatically produced "menu."

Matchmaker™ Softpack

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Selectively search CROMIX and CDOS¹ ASCII files, match key words, and document their occurrence within each file. This convenient, time-saving program is extremely useful in a wide variety of applications ranging from researching a data base to performing powerful word processing tasks.

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Control Data Corporation's Phoenix hard disk drive with DMA industry-standard SMD controller and Cromix drivers from Intelligent Terminals Corporation can be added to your Cromemco system today. With 80-megabytes of fixed memory and 16-megabyte removeable cartridge for back-up, Cromemco users can expand their mass storage to accommodate most any requirements.

CPMSIM² Softpack

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This CP/M³ simulator program by Magic Circle Software (MCS)² allows CROMIX and CDOS users to run virtually any program written for use under the CP/M operating system.

MCS Tape Back-up Softpack

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Drivers for 1/4-inch cartridge tape drives for back-up of CROMIX-formatted disk drives include an interactive program which allows back up and restoration of individual files, directories and entire file systems, using full CROMIX path names.

LYNC⁴ Communications Softpack

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MCS adaption of a popular and very powerful communications package. Fully compatible with the original LYNC⁴ package, which includes the ability to send and receive Text and Binary data with checksums, and a Terminal Emulation Mode. For use under CROMIX, CDOS, or CP/M on Cromemco systems.



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I/O News

The Official Publication of The International Association of Cromemco Users is available through membership in the association. Editorial and advertising policies are designed for the enlightenment of the members in regard to new uses for, and developments of, Cromemco products and other products compatible with Cromemco systems.

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Editor and Publisher

Typography
Dynacomp, El Toro, CA

Printing
Shears Litho, Santa Ana, CA

input...

Editor:

On January 20, 1982, Virginia Communications Associates, Inc., delivered a Cromemco System Two configured for two users under CROMIX, using the Control Data Corporation 96-megabyte Phoenix (9448) Cartridge Module Device.

The CMD 96 is interfaced with Konan SMC-100 Controller boards. The drive was also received from Konan and had been tested with their Controller boards prior to shipment. We had initially intended to use another multi-user system when we learned that Intelligent Terminals had completed its develop-

ment of CROMIX driver routines for the CDC 9448.

We contacted Intelligent Terminals in mid-December and they indicated that the software was undergoing final tests and would be ready for shipment in a few days. A few days stretched — primarily due to the holidays — into about two weeks. We received the driver software without any documentation as it had not yet been prepared.

Naturally, we expected the lack of documentation to present major problems. We did have some difficulty in determining exactly how to set the 55 different jumpers in the Konan Controller boards, and a few in the CMD 9448, but with a few phone calls with Paul Rikieta at Intelligent Terminals to explain the various files on the drive disk, we were able to get the systems up without any problems.

Paul has since indicated that he is completing the documentation which will be included with all future applications.

The driver software includes two different configurations. One is for the 16-megabyte removable disk pack as one device, and the remaining 80-megabyte fixed platters as the other device. We chose the second configuration which establishes the 16-meg. removable and each of the five, 16-meg. fixed platters as separate devices. This makes the backup operation much easier. Of course some applications may need the entire 80-megs. for large data base storage.

By use of the Default utility, we were able to establish the Fixed Platter as the root device (major device 3, minor device 16) and then run a simple Command File to mount the remaining fixed platters and the removable module. Thus, all activity is conducted on the hard disk with the A & B floppies left free for mounting any additional new software packages.

The system configuration includes an Okidata Slimline 125, 200 CPS line printer. In order to interface the printer, we had to change the interrupt signal source on the Okidata 125, and put Switch Position 1 on the PRI J2 to the "off" position. (Many thanks to Buster Irby of Gunn Enterprises, Inc., of Houston, Texas for telling us about the switch

change.)

Everything worked so smoothly that after getting the system up for the first time at 7:00 pm on January 15th, we delivered the system on January 20th and had it up and running with all terminals and the printer two hours later. Our customer is extremely satisfied.

Early on we had serious concern over using CROMIX on a system that would be operated by non-software personnel. (I then thought that CROMIX was extremely complex and difficult.) As we had problems understanding all the complexities of CROMIX, I called Cromemco Customer Service and was eventually referred to Norm Miller. He was extremely helpful and through several phone calls solved many of our problems. On a few occasions Norm did not have the immediate answers, but was able to gather the information and call us back within a day. The positive and supportive attitudes of Norm Miller, and others within Customer Support, have always been helpful and responsive.

We at VCA are now "CROMIX Converts." Several CROMIX users we have spoken with in the past few weeks indicate that once you really use CROMIX, you will not use any other operating system. I am so sold on CROMIX now that I have installed it on the System Zero that I use at home.

We installed all the MicroPro products (WordStar, DataStar, CalcStar, etc.) on the system without any problems. For WordStar, we used the WordStar Customization software from ADC Associates of Palo Alto, California. The primary software for the customer's use was written in Cromemco COBOL (Version 04.01). We are now beginning to use Cromemco FORTRAN under CROMIX.

I cannot end this letter without throwing some roses at Ms. Bovina Carey in Cromemco's OEM Sales Department. Ever since we began as OEMs it has been a joy to all of us at VCA to have her as our representative. "Bo" has always been helpful, cheerful and responsive. Thank you. Sincerely,

Mervin L. Norton
President

Virginia Communications Associates

CD

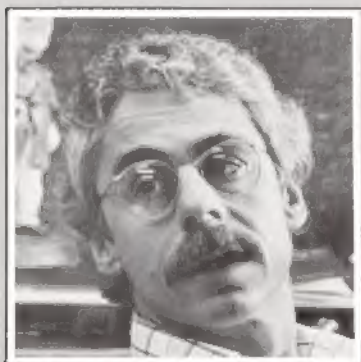
System One-H Running at IACU

Well, it's here. And it's a beauty. Our System One-H is finally in and the joys of learning CROMIX, developing an expanded database, and exploring this dandy little computer have just started. And a dandy little computer it is. Faster than we expected, it allows us to have instant access to all our files, process editorial material, enter our insurance information, get our accounting caught up — in short, everything we hoped it would do — and more, lots more.

We will be reporting our progress periodically. Things like how well we think the CROMIX manual teaches the user, and generally what we experience in computerizing what has been, primarily, a manual office.

In the meantime, we are luxuriating in the knowledge that we possess the finest desktop computer in the world. What a feeling!

output



Members Survey

Enclosed with this copy is a separate survey form. It will be greatly appreciated if you will take a few moments to complete the survey and return it to us as quickly as you can. The information we gather can only help I/O News stay in touch with your interests. It may also result in

new products or services from Cromemco, as we plan to share the data we receive in order to let them know what their most avid users say.

Insurance in Force

The response to IACU's group insurance plan was more than sufficient to enable us to put it into effect. The first phase, casualty insurance coverage for computers, peripherals, and software is in force now. Those who indicated interest have been sent applications. Some of the features of this policy include replacement value coverage, protection against power caused damages and faulty repairs, and specific coverage while equipment is in transit or in a temporary location. An optional feature is income protection following damage or while computers are inoperable. All coverage is based on 75¢ per \$100 valuation.

After shopping for a long time, we feel this is a very favorable rate. Especially when you consider it is with a nationally recognized company, The Firemens Fund. We know of no other computer users' association that offers such a plan.

The group health, disability and life plan is still being investigated. We hope to achieve comparable quality, benefits and favorable rates with this plan, although it is more difficult. Most insurance companies would rather not be in the medical insurance field. The more who apply for these coverages, the greater our bargaining power with the insurance companies.

Medical Applications

One of the most significant areas of growth in the use of microcomputers is in medicine — medical research, testing and test analysis, and now in clinics and private practices. This is an area where some

phenomenal stories could be told. We would like to be able to tell many of them. So far, in spite of what is occurring, we have received far too few articles detailing these exciting applications. We have many members in virtually every end of the medical spectrum, and this is a plea to those specialists. How about sharing some of your experiences with your colleagues through our pages? The invitation is open.

Ditto for Educational Applications

For those of you who are futurists — in this case near futurists — educational applications offer tremendous room for growth. We know that there has been a lot of work done in this area in the United Kingdom countries, and we have some articles starting to emerge from members. But, there is so much to be done we feel that many of you can contribute to spreading the word through I/O News. Again, the invitation for articles is very, very open.

PL/I Used Under CDOS

Several members have asked about the use of Programming Language One on their systems. George Inglessis, in Vineland, New Jersey, reports that he has been using PL/I-80 (by Digital Research) for some months under CDOS and it has been working flawlessly. Further, he reports that the documentation is excellent, and that error treatment at compile time is very helpful.

He has used PL/I-80 to program the storage and retrieval of a database for the classification of over one thousand organic chemicals by structural characteristics, as well as for literature reference retrieval and other business uses.

George Inglessis would like to communicate with others who have experience with PL/I on Cromemco Systems, especially with chemical applications. Contact I/O News and we will forward information to him.

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Continued from Front Page

A Universal Microcomputer Local Area Network

An Examination of System Architecture

The architecture available for implementing networks is based on packet switching network techniques where each user station, or node, generates a small packet of information which is transmitted to another node or nodes over the network transmission medium. Of the numerous different networks proposed or available, no one standard system has been adopted. Thus, the user is faced with a choice of one of several types of incompatible systems.

Network system architecture is described in layers, as in the physical link layer, the data link layer, and so on up to the User Interface layer, which is the highest layer in the system. A system itself can be laid out in one of several topologies. The most common ones are the star (or cluster) configuration, the ring network, and the bus network. The star configuration is illustrated in Figure 1A.

Anticipated Areas of Use

Local Area Network specifications are one of the most rapidly proliferating developments of the past year. Some two dozen different networks all claim to be the best at linking individual computers to form a distributed processing system or "automated office." While the Office of the Future concept is one very valuable application of local area network technology, it is not the only application of interest. Factories and scientific laboratories are two other areas where networking technology can be combined with the power and cost-effectiveness of small computers to increase productivity. Local Area Networks are also being used as educational tools, enabling schools to integrate computing power at many different levels and explore new methods of instruction.

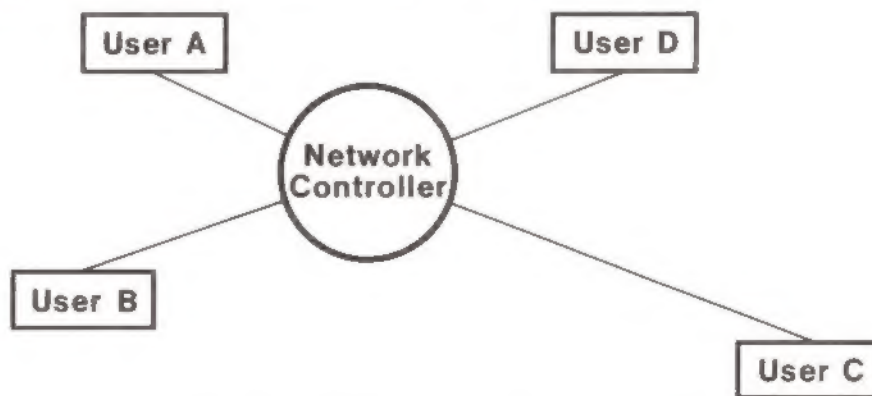


Figure 1A. The Cluster Configuration Local Network.

Continued Next Page

This configuration connects each user station directly to a central network control unit, much like spokes leading into the hub of a wheel. This cluster-type of configuration minimizes the hardware needed at each

node, but necessitates the purchase of an expensive central control unit. Flexibility in arranging the network is also hampered by the requirement that all remote stations must be connected directly to the central processor.

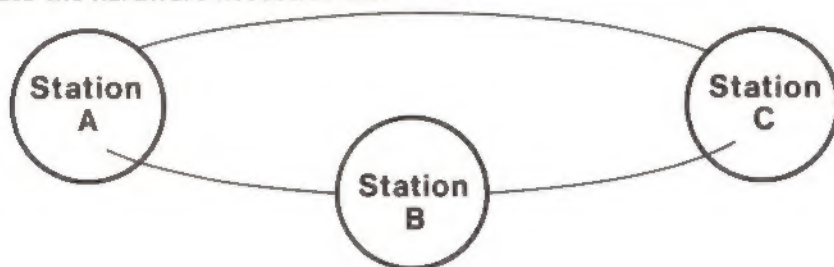


Figure 1B. A Ring Configuration Network.

An alternate approach, the ring topology, links all nodes together sequentially, so that the system appears as a large closed circle with user stations connected on the periphery. This offers advantages over the cluster arrangement in that the hardware requirements are distributed over all the nodes and that the system geometry is more flexible. However, the flexibility is still limited by the requirement that the circle be closed. Also, if any one station on the ring breaks down, the entire network is shut down (like some strings of Christmas tree lights).

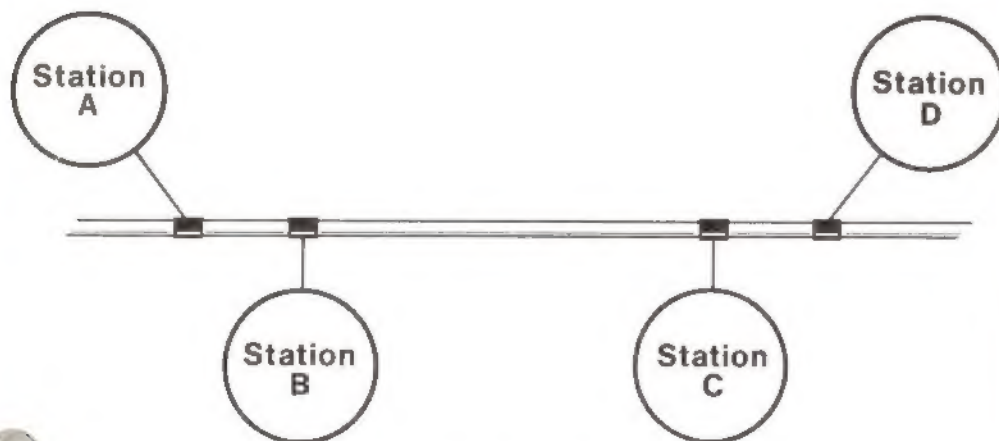


Figure 1C. The Bus Configuration Network.

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New Hard Disk Announced for System Two and System Three

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drive brackets. In fact the HD-5 actually attaches to the floppy disk drive mounting brackets, so that no additional holes need be drilled for mounting. In the System Three the HD-5 slides into the space which would otherwise be used by the optional "C" and "D" dual floppy disk drives. System Three computers equipped with the additional dual floppy option (option 002) cannot accommodate the new HD-5 module.

The WDI-II disk controller which Cromemco provides with the HD-5 replaces the WDI controller in the Cromemco product line. The WDI-II can be used with Cromemco 8" disk drive products (in the Z2-H, HDD-11, and HDD-22) as well as with the new 5" disk drive. (The older WDI is not compatible with the 5" disk drives.)

The WDI-II consumes less power than the older WDI for less heat dissipation, thus more reliable operation. The WDI-II is also the first Cromemco circuit board to be manufactured without integrated circuit (IC) sockets. By soldering the IC's directly to the printed circuit board the reliability of the electrical contact between the IC and the printed circuit wiring is assured without having to rely on the mechanical contact of the IC socket.

With the WDI-II, not only are you assured that IC's will not work their way out of sockets, but you can also be assured that the cable connecting the WDI-II to the disk drive will not be pulled loose. Special locking latches are provided on the WDI-II cable connector to assure that the cable is

always securely seated in place.

New versions of both CDOS and CROMIX have been released which support the new 5-megabyte disk drive. The new version of CDOS is 2.50 and the new version of CROMIX is 11.08. A new INIT program is also provided which automatically labels the drive at the time it is initialized. The new versions of CDOS and CROMIX include drivers for the 5-megabyte hard disk which are linked into place by the CDOSGEN or CROGEN utilities.

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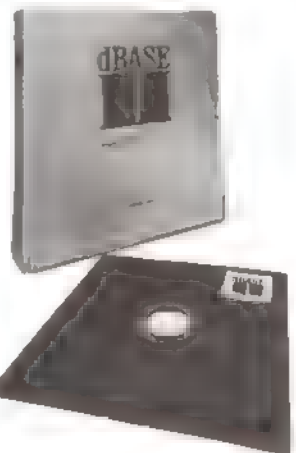
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Implementation of Hardware Clock/Calendar Board

By Michael Turnage

A hardware clock/calendar board can be a valuable tool for the user writing software for internal application. Further, it can be an efficient addition for users of the Cromemco 3100 and 3101 terminals requiring time and date functions. Interacting with the hardware clock/calendar board, software can remove requirements for entering date and time for many day-to-day activities.

Direct applications include time or date stamping of reports, checks, letters, file updates, and calculating time intervals. For example, our general ledger program interacts with the clock/calendar board to limit operator entries. In turn, our invoice program interacts with the clock/calendar for the date, and creates an invoice number from the date and time. Applications of this ingenious board are limited only by the imagination of the programmer.

The clock/calendar board has become a popular overlay addition in many offices, and has been improved to the point of being offered with a back up system which allows the board to maintain the correct time with computer power off. The one drawback to this system is that many boards require the programmer to have knowledge of assembly language. This article is being written to remedy that situation, and to demonstrate how a clock/calendar board can be programmed from BASIC.

The QT clock/calendar board is readily available from most suppliers, and was selected because of its battery back up function, low

cost and ability to be programmed from BASIC. A quick run-down of this product's capabilities, as well as an implementation of the board are covered in the following step-by-step installation procedures, comments and descriptions.

The QT board is made of high quality epoxy glass. Workmanship is above average, and all components are screen labeled. Its 25-page manual is well written and, while it clearly explains the operation of the product itself, the BASIC software programs supplied are not, in my opinion, operational. Corrected BASIC programs are supplied in this article.

The QT clock/calendar board uses a MSM5832 real time clock/calendar chip, with a 3.6 volt rechargeable Ni-CAD battery mounted on the circuit board. It plugs into the computer card cage and receives power through the computer power bus. When the computer is on, the Ni-CAD battery is recharged and when power is removed from the system, the battery switches in to power the clock/calendar chip. The I/O addresses are controlled by a 32.768 Hz crystal time base which provides a 4-bit I/O data line for the seconds, minutes, hours, days of weeks, dates, months and years. All data access is controlled by a 4-bit read/write and hold input address.

The clock/calendar has 13, 4-bit registers, and all data stored in its memory are numeric. The 13 registers have the following meanings:

Register/ Address	Data Description	Values
0	SECONDS UNITS DIGIT	0 TO 9
1	SECONDS TENS DIGIT	0 TO 5
2	MINUTES UNITS DIGIT	0 TO 9
3	MINUTES TENS DIGIT	0 TO 5
4	HOURS UNITS DIGIT	0 TO 9
5	HOURS TENS DIGIT	0 TO 1
6	DAY OF WEEK DIGIT	0 TO 6
7	DAY OF MONTH UNITS DIGIT	0 TO 9
8	DAY OF MONTH TENS DIGIT	0 TO 3
9	MONTH UNITS DIGIT	0 TO 9
10	MONTH TENS DIGIT	0 TO 1
11	YEAR UNITS DIGIT	0 TO 9
12	YEAR TENS DIGIT	0 TO 9

Each digit of information has an address. Therefore, when programming, an address for each digit must be specified.

I/O Port Select

The first step in making a system ready to accept a clock/calendar board is to select the I/O address port by setting the switches on the rocker switch bank labeled SW1 on the circuit board. As we operate in CDOS, we chose an I/O port decimal address range of 248 251 because CDOS I/O activities are handled below this level. The six rocker switches selection, which make up the switch bank of SW1 and the I/O port address, are as follows:

I/O Port Address Select (SW1 Six Rocker Switch Bank Selection)

SW1	SW2	SW3	SW4	SW5	SW6
off	off	off	off	off	on

Continued Next Page

Now that we have selected the I/O port address, our next step is to install the clock/calendar board into the computer card cage. First, turn your system off. Next plug the clock/calendar board into the card cage, aligning pins 1 and 50 with the same pins on the S100 bus connector. That is all the hardware installation required for use of the clock/calendar board.

Programming

A programming chart has been provided to assist in setting, reading and writing data to the hardware clock/calendar board. The chart is well-designed, and easy to understand. (See figure 2)

Hold Signal

The hold signal is used to prevent the internal clock register from rolling over during read/write operations. It must be held active for 150 microseconds before performing read/write operations, but must never be raised (activated) for over 1 second.

Programming Routines

We have provided three basic routines: the set clock/date routine, a read clock routine, and a read date routine. We separated the routines to facilitate writing them into programs

SET CLOCK/DATE ROUTINE

```
10 C1 = 250.C2 = 249
20 OUT C2,16
30 INPUT "ENTER REG. ADDRESS 0-12 ".N
40 INPUT "ENTER DATA 0-9 ".T
50 OUT C1,N
60 OUT C2,T + 16
70 OUT C1,N + 16
80 OUT C1,N
90 OUT C1,N + 32
100 D = INP(C1)
110 @D
120 OUT C2,0
130 END
```

DATA DESCRIPTION	SECONDS		MINUTES		HOUR		DAY OF WEEK	DAY		MONTH		YEAR	
	UNITS	TENS	UNITS	TENS	UNITS	TENS		UNITS	TENS	UNITS	TENS	UNITS	TENS
REG	0	1	2	3	4	5	6	7	8	9	10	11	12
+32	32	33	34	35	36	37	38	39	40	41	42	43	44
+16	16	17	18	19	20	21	22	23	24	25	26	27	28
BITS	8	•	•	•	•	24	•	•	•	•	•	•	•
	4	•	•	•	•	AM/PM	•	•	28/29	•	•	•	•
	2	•	•	•	•	•	•	•	•	•	•	•	•
	1	•	•	•	•	•	•	•	•	•	•	•	•

*ACTIVE BITS

Figure 2. Programming Chart

The set clock/date routine was written to set one register at a time. This is because a register may occasionally need readjusting. To set all registers the program will have to be run thirteen times, setting registers zero through twelve at one register per run. The following events will occur in the listed sequence.

10. Define the I/O address.
20. Raise the hold signal to the data output port by writing a 16 to the port
30. Select the register address which will receive the data.
40. Select the data to enter in the register 0-9.
50. Write the register address to the address output port.
60. Write the data and hold signal to the data output port. (The 16 will keep the hold signal active.)
70. Write the address and hold signal to the address output port. (The 16 will raise the write signal)
80. Write the register address to the address output port. (This will lower the write signal)
90. Read the register address
100. Read the data from register address.
110. Print the data.
120. Write a zero to the data output port to lower the hold signal.

The program is a simple routine which can be used to set a digit into

any register and read back and display the data.

Continued on Page 42

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Continued from Front Page

results were worth the time and money.

I'm a part of the Emissions & Fuel Economy Development group at American Motors Corporation (AMC). We're the part of Engineering that works on development and testing of all of the products AMC makes that are subject to any regulations concerning emissions and/or fuel economy. In short, just about everything AMC makes. One of the many development things we do is test and evaluate how well vehicles move down the road given certain combinations of body, tires, and accessories. We do the actual, on-road testing. We also do a large number of other things, but I'm only going to talk about a very narrow range of testing here.

Over the years that automobile manufacturers have been involved with complying with regulations on vehicle emissions and fuel economy standards, a number of different testing procedures have either come into existence or have been modified from 'traditional' testing procedures. All of these procedures have one or two basic requirements in common: you have to take data during a test; and you have to evaluate the data to know what happened. (You also have to live with one of the sub-rules of Murphy's Law: 'Under the most rigorously controlled conditions of pressure, temperature, volume, humidity and other variables the organism will do as it damn well pleases. Makes life difficult, but not completely impossible.)

It fell to me to improve the way we did the data analysis in one particular body of testing. It used to be that our Road Test people would take themselves and all of their equipment out, run tests, record the data, and analyze the data through our corporate computer system's time sharing facilities. The data was transmitted by long distance telephone lines. That seemed a bit silly, and I thought that taking along a computer system would make life a whole lot easier for the Road Test guys. Well, it did; but it took us a while to get there.

My particular problem involved a Cromemco System Two, FORTRAN, and an application called Coastdown. Without going into all of the dreary details—but to give you an idea of what Coastdown is and why it's done—let me explain a bit. Federal test procedures require that chassis dynamometers be used for fuel economy and emissions testing. The dynamometers simulate both the dynamic and steady-state loads on a vehicle's drive train for emissions and fuel economy testing to provide an accurate representation of road experience. (Inertial flywheels in the dynamometer simulate the dynamic effects of vehicle weight, and the dynamometer power absorber unit and rolling resistance of the drive tires provide the steady-state load.)

There are a few ways to determine the power absorber settings. You can photograph a representative vehicle's frontal projection, digitize the photograph to determine the frontal area, and use the results with an equation to determine the road load horsepower setting necessary for the power absorber unit. Or you can use fixed tables based on vehicle weight. Or you can use Coastdown.

Of the three mentioned, Coastdown is by far the most expensive, but it's also much more realistic than using fixed tables or formulas, since product improvements which reduce road load (air dams, improved tires, and more slippery aerodynamic shapes) are represented. Fixed tables and frontal area (which really only account for weight) don't accurately represent the picture. For instance, remember when you were a kid and held your hand out of the window when the family car was going down the road? Holding your palm to the wind made for a lot of resistance; holding your palm down made your hand sail. Your hand didn't weigh any more or less in either attitude, but it sure was easier to move it through the air as an aerodynamic shape than it was as a small wall. The same principles apply when using real world Coastdown instead of tables and equa-

tions.

Coastdown is really just what it sounds like. You accelerate to a certain speed, put the transmission into neutral, and coast down to another speed. Of course, you take data on velocity all through the coasting process. Otherwise, why bother? And, you do a number of pairs of coasts (one in each direction) to "wash out" all of the little random errors that creep in, because the real world is not perfect. (Is this starting to sound like statistics?) The longer the coast time—with a given configuration—the lower the road load.

There are a number of forces acting on a vehicle when it is coasting, and obtaining adequate test repeatability requires that you correct observed road load data to standard conditions of temperature, barometric pressure, and wind. The corrected data are evaluated by a regression analysis, and an appropriate dynamometer power absorber unit setting is obtained. You're looking for the lowest possible power absorber unit setting, because the lower the setting, the lower the emissions and the higher the fuel economy. (Yes, Virginia, fuel economy IS a computation from emission levels.) Basically, what happens is, the effects of temperature, barometric pressure, and wind are washed out and what is left are the effects of tires, weight, and the aerodynamics on the vehicle.

So far, this sounds pretty easy. Gee, all you need is a vehicle, a good driver, a road, some recording equipment, and some analysis gear. Right? Well, not really. The key phrase is, "...correct observed road loads to standard conditions..." It's the standard conditions that are the killers. To really be able to get repeatable tests, you have to have virtually no wind, a very steady barometer, an almost constant temperature, and a very long, flat road. Such things do not exist in Michigan, where most automobile manufacturers have their test facilities. The wind blows a lot here, so there are few times that testing can be done

Continued on next page

in large, economical batches (usually just about dusk the wind drops to almost nothing, but it doesn't stay that way for long). Some manufacturers do test in Michigan, but we choose to do our testing in the Everglades in Florida—over a thousand miles from home—just because an almost perfect road exists there, and the weather conditions are just about right most of the time. The road is called Alligator Alley. Yes, it's aptly named. It runs on a dead straight line for most of its length from Naples to Ft. Lauderdale. At night, temperature, barometric pressure, and wind are just about perfect for Coastdown, so we test from about 6:00 pm to somewhere around 3:00 am every day we're there.

Doing remote site testing like this (particularly when it's as complex as this kind of testing and involves the number of vehicles and people that it does) is expensive. A logistical nightmare that requires you go with everything you're going to need, to do everything you will have to do. (For instance, the site will all of a sudden take on the appearance of a transportable but major "service station," specially made for both humans and machines. Imagine, if you will, a movie set of a road test.)

We've built a mobile laboratory on a motor home chassis. It contains all of the tools, communications, electronic instruments, parts, fuel, electrical power generating capability, and other things needed to successfully and comfortably carry out Coastdown testing. We are fully self-sufficient when we set up on any site anywhere, to do any kind of testing we have to do. We also have the capability to conduct data analysis on-site through the use of our microcomputer. (Were you wondering when I was going to get back to this part?)

Once again, the key phrase involves the correction to standard conditions and regression analysis of data. The computer program that does this is basically evaluating multiple non linear simultaneous equations in multiple unknowns. This is not a job for interpreter BASIC, assembly language, or most other methods. One is almost stuck with FORTRAN.

The problem with FORTRAN (and

all other languages used on microcomputers and many minicomputers and mainframes) is that all of the computations take place in software. That means that they are slow. Larger—read more expensive—computer systems use firmware, or specialized electronics, to do the computations. That means that they are fast. Computing Coastdown, as I mentioned, originally took over forty minutes for results to be calculated on one vehicle; one test data set. Figuring that we do about 16 to 20 test sets in a night, forty minutes for analysis of each set eventually puts you into the next century waiting for data (shades of early computer days).

Obviously, a better way had to be found. And it was. There are firmware Arithmetic Processing Unit (APU's) available for micros. These truly supercharge your math processing capabilities—sort of a "Gofast" switch. The catch is, the user must really dig to find out how to use them, where to get them, and—worst of all—how to program the bloody things. They're fast, there's no two ways about that. My forty-minute computation time dropped to about four minutes (not BY four minutes, TO four minutes!). Anything that good just has to have a catch. It does. It's expensive and extremely difficult to figure out how to use.

I knew that microcomputer APU's existed. (NASA uses them on all of the deep space probes it sends off to other planets.) It didn't even take me too long to figure out where to buy one and the board in which to plug it. But it did take just about forever (the next century?) to find out how to use the fool thing!

First, let me give some credit where credit is due. There are, as far as I know, only two vendors of APU's. Advanced Micro Devices (AMD) makes the 9511 APU; and Intel makes the same thing, but calls it an 8231 APU. Both are configured as fixed point and double precision (16/32 bit), and floating point single precision (32 bit) devices with add, subtract, multiply, divide, trigonometric, square root, logarithm, exponentiation, and other math functions. (AMD makes a 9512—Intel's 8232—device with only add, subtract, multiply, and divide, but

with more bits for fixed and floating point operations. We're not, however, concerned with them.) Mostly, this device gives you a sophisticated, multi-function scientific calculator sitting at a port address. All you need do is learn how to send data to it, punch the right buttons to make it work, and read the answers back. That, as they say, is the rub.

What I had to do was make a replacement for Forlib, which is all of the software routines that do the math for FORTRAN. The replacement had to be in assembly language that would perform all of the math in the firmware, and exactly mirror what Forlib "looks" like to FORTRAN. Believe me, it wasn't easy.

I'm no different than the next microcomputer type—I'm just a little bit nuts when compared to the balance of the population. I LIKE programming in assembly language! (Do we all have masochistic tendencies, or is it just me?) Or, at least, I did like programming in assembly language until I started fooling around with floating point math. The folks at

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By Jordan Siedband

The use of simultaneous linear equations with real coefficients is well documented in any college algebra book. The solution of the same problem with complex coefficients is especially important in the solution of alternating current networks. In the process of learning the C language, I sought a problem which would be substantive as well as a good learning experience. The

solution of simultaneous systems seemed to be a good starting place.

The method chosen is the obvious Gauss method. Errors inherent in many pivoting methods are minimized by use of double precision. Solution of the real case is straightforward. The complex case is simple when one realizes that any complex number $a + bj$ may be represented by the matrix:

$$\begin{bmatrix} a & b \\ -b & a \end{bmatrix}$$

Thus, a 10×10 complex matrix may be replaced by a 20×20 real one.

The version shown is for CDOS. Change the "include" line to `stdio.h` for CROMIX use. I hope that you can find uses for the routine. I strongly urge you to leave the little assembler routine in the program so that "version" will work in CROMIX.

```
#define PI 3.1415926535898
#include "cdstdio.h" /* may be changed for CROMIX by using stdio.h */

main ()
/* linear systems of equations real or complex coefficients */
/* Jordan Siedband (312)674-1175 12/05/81 */
{
    static double a[40][41], x, real, imag, mag, angle;
    double arctan(), sqrt();
    static int c, flag, i, j, k, l, m, n;
    unsigned status;

    #control basm
    JR DONENAME : inserts name of program into version
    DB OEDH, OEDH, 0, 9
    DB 'Linear Systems Real or Complex J.Siedband 12/05/81'.OAH,
    DONENAME:
    #control easm

    start:
    printf("\n\nSIMULTANEOUS LINEAR EQUATIONS. R=REAL, C=COMPLEX? ");
    c=getchar();
    switch (c)
    {
        case 'R':
        case 'r':
            flag=1;
            break;
        case 'C':
        case 'c':
            flag=2;
            break;
        default:
            flag=0;
            break;
    }


    if (flag==0) goto start;

    if (flag==1)
    {
        printf("\n\nSOLUTION OF LINEAR SYSTEMS WITH REAL COEFFICIENTS\n");
        printf("Number of Unknowns =? ");
        scanf("%d", &n);
        if (n>40)
        {
            printf("\nMaximum Number = 40\n");
            exit (status);
        }
        for (i=0; i<n; ++i)
        {
            for (j=0; j<n; ++j)
            {
                printf("\nA(%d,%d) ", i+1, j+1);
                scanf("%g", &x);
                a[i][j]=x;
            }
        }
    }
}
```


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The program also requires the use of a math library in C. Should you not have such a library, the author would be happy to send this program and a copy of a math library with documentation on any sized CROMIX disk of your choice, IF, you send me an initialized disk with the proper return postage. Sorry, I will not make up any postage due, nor will I be responsible for that mainstay of American life, the United States Post Office! 

Jordan Siedband
5017 Fairview Lane
Skokie, IL 60077
Telephone (312) 674-1175

(Editor's Note: The last time we ran some of Mr. Siedband's handy programming tips, we were advised by some excellent software types that his programs are pure genius. We have also talked with people throughout the midwest who retain Mr. Siedband as a consultant and who feel he can solve any problem imaginable. Thus, we are always pleased when he can find the time to send us some more of his discoveries to share.)

About the Author

Harper College, Palatine, IL, received an E.E. degree from the University of Cincinnati while still in uniform in 1944. After WW2 he received his BS and MS in mathematics from the University of Chicago and took most of his course work for the Ph.D. in Mathematical Physics from Illinois Institute of Technology. He has been a CROMEMCO user since 1977. His consulting began in 1970 mostly on table-top programmable calculators/computers where he earned the important lesson think small. Since then he has worked on larger systems which was the major factor in choosing CROMEMCO in the first place. His engineering background has been eminently successful in solving scientific as well as business problems.

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Observation's on Cromemco's New Version of COBOL: Version 04.60

By Jim Alewel

There are three major differences between the new COBOL version 04.60 and the current version 04.01. Each one is, in itself, an outstanding improvement or addition.

The improvement that is first and foremost in my opinion, is the addition of a symbolic interactive debugger that works at the "source line number" level. This powerful tool gives the COBOL programmer the ability to control the logic flow of his COBOL object program, and look at the contents of any non-indexed data-name interactively. Here are the functions currently available in the "preliminary version" sent to me:

1. List previously set breakpoints.
2. Set breakpoints at desired source line numbers
3. Exhibit contents of data-names interactively
4. Resume processing at next statement
5. Resume processing at any desired line number in the procedure division
6. Remove individual or all breakpoints previously set
7. Display current source line number
8. Quit the program
9. Execute one statement
10. Set trace on and set trace off

In order to provide this capability, the new compiler automatically generates a new file with the extension ".DBG" in addition to the ".REL" and ".PRN" files currently produced. During the linking process, a newly supplied file "DEBUG.REL" may be included with the other modules being linked to implement the "DEBUGGER." When the linked program is then executed, a breakpoint is automatically set at the "logical" beginning and end of the program;

the debugger takes control, identifies itself, and provides (by typing "Help") a self-explanatory list of the commands.

Cromemco feels additional features should be added before general release. These include the ability to change values in data-names and provide access to indexed or sub-scripted data-names. (My opinion: Please hurry! This is a super programming aid.)

When your program is completely debugged, a re-compile using the new compiler option "/D" will suppress generation of the ".DBG" file and remove the line number captured in the ".REL" file, saving 2 bytes per line of procedure division.

The second difference in this newest version is the inclusion of a new and greatly improved method of handling indexed files.

Without consuming the remainder of this article with methodologies employed in each version, it suffices to say that the current version (04.01) uses a string and pointer algorithm; and the new version (04.60) uses a binary-tree or, simply, 'b-tree' method of organization. The b-tree method orders data (keys with pointers in this case) into a given area until that given area is full. Then, as the name implies, the area is divided into two areas (half in each connected by forward and backward pointers), and ordering of data continues. Searching for a specific key using this b-tree method is more efficient than sequentially following a string, since a maximum of only two compares are required to determine if the desired record is contained in the given area.

To find out how much more efficient the new b-tree method was in comparison to the current string

method, a program was written to load an indexed file, while another program was written to access the same indexed file. Each program was compiled and run on the same equipment and in the same environment; the only difference was the compilers used.

EQUIPMENT: Cromemco System 3
using 16FDC controller running
CDOS 2.36

DATA: 2000 random records 54
bytes long with 30 byte keys
records contained 1500 random
duplicate keys

PROGRAM 1: Read data file above
and created 500 record indexed
file

RESULTS: 04.01 version time: 88
min 44 sec

04.60 version time: 21 min 11 sec
Improvement: 419%

PROGRAM 2: Read data file above
and look up each record in the in-
dexed file

RESULTS: 04.01 version time: 58
min 14 sec.

04.60 version time: 14 min 04 sec
Improvement: 414%

The above tests were run against a specific data set. A different data set with more or less records containing different sized records and keys would most likely generate different results. My overall observation seems to indicate the new COBOL version 04.60 is substantially faster than the current COBOL version 04.01.

Need I say more?

The third difference is that the amount of disk space required to hold executable files is only a fraction of what is required using the current version.

This is because the runtime portion of the current compiler has been removed from the linked modules

Continued on page 23

A Review of dBASE II: A Relational Data Base Manager

By Richard Quinn

Anyone who has ever struggled through the development of a custom data base knows how much time and effort it can take. After the data is organized and lengths, sizes, etc. defined, you begin assigning variables. If the program is of any size of importance, equal time is spent documenting and recording what has been done, so you can follow what happens. After that, hours are spent on structure, coding and form, followed by the inevitable debugging.

There are a number of general purpose data base programs around. The problem with most is that they are either slow or so general they can't be fit to specific needs. Worse, it is often difficult—or impossible—to develop custom menus, reports, or output for user interface. Most have fixed structures for input and output, and provide little in the way of user customization.

The primary problem comes from a good number of programs claiming to be data base systems, when in reality they're simply file managers. Many have used these file managing programs and, as a result, become discouraged with general data base programs. That is why I'm excited about a new relational data base management program I've only recently begun to use. Written by Ashton-Tate, it's called dBASE II, and it meets its promises by performing within the parameters set up by data base program definition.

To best explain the workings of dBASE II, let me backtrack to basics. There are three primary types of data base systems: hierarchical, network and relational. The main difference is in the way each handles the data stored.

Hierarchical data bases are common on large machines, but are notorious for their difficult and expensive setup costs. Their structures resemble trees. An example would be "supplier" as the "root," with

specific parts or part numbers as the "branches." This system requires the difficult task of developing pointers to determine the locations (branches) of stored data.

The network method has the advantage of allowing "many-to-many" relationships between data. It is, however, also difficult and time-consuming in development—but does allow for "navigation" within the data base. The inner connections within the data base can become very complex.

The last type, of which dBASE II is made, is the newest addition: relational data base management. The files consist of two dimensional arrays which can be linked. If, for instance, you had a mailing list with NAME, ADDRESS and ZIP, the horizontal array would contain a field for each item. All items together would compose one record. You could, however, list the data vertically by, say, the first field, NAME. Therefore, treated horizontally, the data would compose an entire record with data for each field. Vertically the data could be manipulated by a specific data field. Sorts could be performed, and new data bases containing the same data in a different form—or keyed by a different field—are all easy and fast to key in. Furthermore, the relation of one field to another is easy to understand, thus simplifying the data base structure.

For an individual who is not a programmer, relational data bases are easier to set up and use. After installation the relational data base is also easier to use, as the links, or relationships between data, are less complex and easier to follow. The relational data base is clearly fitted to the needs of the typical micro user.

dBASE II by Ashton-Tate is one of the best DBMS systems I have used. I was instantly struck by a number of advantages this system has over others, and will give you a short summary of each.

1) The system was written in assembly language and has the speed and compactness associated with assembly language. Most messages are contained in overlay and message files, and are automatically called by dBASE II when needed. This leaves much of the main memory for processing.

2) dBASE II is the only program I have seen that comes with a trial copy modified to limit the number of records to ten. The master copy is sealed in plastic, and the whole package can be returned in 30 days for a full refund if the master is still sealed. In addition, the demo disk has a number of simple programs written for dBASE II. They make initial testing/startup much faster. This lends a perfect method of finding out whether or not it will do what you want, at no risk to you or your cash flow.

3) dBASE II allows for 64K records per file, 1000 characters per record, 32 fields per record, 254 characters per field and 10 digits accuracy. I found that there were applications that required more fields per record, but it was a simple matter to combine fields or structure a separate data base that could be combined under program control. Record location is fast—less than 1 second average for a Cromemco hard disk system.

4) The manual is well-written, and divided into two parts. The first section is for non-programmer types, the second being geared more towards programmers. It does have some errors and omissions, but those are being corrected by the Ashton-Tate folks, who seem dedicated to the task. The main problem is in the second section, where easy ways to reference commands are not always given. An alphabetical index at the end of the manual would be of great help for both sections.

Continued on next page

5) One of the best features is the strict structure of the program. All of the familiar constructs of structured programming are present. The easy-to-remember English language-like commands make learning a breeze and joy. Programs can be run from "comma-d" files created using the SCREEN editor, or run in real time from the keyboard, which essentially facilitates program development and debugging. Some of our customers, for instance, are even using dBASE II to work with data base files generated from BASIC programs—or vice versa.

6) Data bases are easily created using the CREATE command. Variables are names up to 8 characters in length—not symbolic—making them easy to remember and use. Adding, editing, deleting and sorting are all intrinsic commands, and all of the normal overhead is handled by dBASE II.

Programmers used to the structure of languages like PASCAL, C, PL/1, ALGOL and Structured BASIC will appreciate the structure of dBASE II. It is so good, I personally feel I have not only gained a powerful and useful data base system, but a new and powerful structured programming language.

It is obvious from this dissertation that dBASE II will be a popular program in our office. It has us up and running fast—creating, reporting and quickly changing data bases. Obviously custom needs will still require custom software development. But data base management, which describes many business applications, can be up and moving as fast as any plug-in applications program with dBASE II. **DD**



About the Author

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TecTps.
member

PlanMaster Released

Cromemco has just announced the availability of its new financial planning general purpose numeric analysis package called PlanMaster.

PlanMaster provides automatic spread-sheet analysis for hundreds of applications including financial planning, cost accounting, sales forecasting, production planning, cash flow analysis, and scientific data analysis.

With PlanMaster, the user can easily modify the format to meet the requirements of any project. Since the program automatically recalculates all appropriate totals with each new entry, tedious hand calculations are eliminated. The PlanMaster program can produce a ledger and balance sheet, a chart, a bank statement, an expense account record, or any one of a variety of formats the user designs for specific business, engineering, and scientific applications.

A key feature of the program, and the basic calculating tool, is the Plansheet. Under the CROMIX operating system, a single Plansheet can include 10 or more separate pages, over 1000 lines, or up to 130 col-

umns, allowing the program to accommodate very large projects.

The terminal screen provides the user with a window for viewing and entering data on a portion of the Plansheet. The user can move (scroll) the window up, down, left or right or access various portions of the Plansheet when needed.

The Plansheet is comprised of two separate and distinct sections, the matrix area and the format area. The matrix area is a rectangular array of columns and lines which is reserved for numeric entries. Under CROMIX the area available for numeric entries in each page is 13 columns across and up to 101 lines.

The format area is reserved for descriptive information such as line and/or column captions and project titles. The program operates as a word processor in the format area so the user can type in the appropriate labels for each line or column. The program guides input by preventing access to protected fields and limiting restricted field entry to the proper type of data. A terminal beep signals any entry error.

A powerful feature of the Plan-

Master program is the DEFINE command which allows the user to easily produce simple arithmetic calculations or even the most complex calculations required for very sophisticated applications. Using the DEFINE command, the mathematical relationships between line and column entries can be specified by the user. These specifications, or equations, may include letters, numbers or labels representing lines and columns, and arithmetic and relational operators.

When entering or changing definitions through the DEFINE command, it becomes extremely important to check the accuracy of the data. PlanMaster can do this for the user with the VERIFY command. VERIFY will examine the define formula and recalculate all Plansheet data to make sure that the Plansheet is consistent with the definitions for every line and column.

PlanMaster is available from Cromemco dealers on 5" floppy diskette (Model PLMR-S) or 8" floppy diskette (Model PLMR-L) for \$295. **CD**

Continued from page 15

Supercharge FORTRAN: Use an Arithmetic Processing Unit

Byte have some very nice information about floating point, and they'll sell you a copy of their user-contributed math library. Good luck trying to understand it; I still don't. The folks at Byte have a number of publications of back issue articles, many of which discuss floating point and how to apply it. Again, good luck. It took me about six days to write a trustworthy floating point add, subtract, multiply, and divide routine that interfaced with the APU chip. (I say trustworthy. That means tested and proven under all conditions for which I could imagine and design tests.) I more or less gave up before I got to the trig and other functions, but especially when I tried to interface to FORTRAN.

One has a very difficult time getting hold of enough documentation concerning Microsoft (Cromemco) FORTRAN to be able to interface anything to it.

Enter the International Association of Cromemco Users (IACU). A couple of telephone calls to California, a number of telephone calls to the vendors listed in the I/O NEWS, and voila—help! Some very nice folks at InfoSoft Systems, Incorporated not only knew what I was talking about when I asked for a Forlib that supported the APU, they also knew where to get one!

Another telephone call—this one to Redding Group, Incorporated—yielded APULIB, Redding Group's support software for FORTRAN and

the APU! A purchase order was issued, I waited a few days, and what to my wondering eyes did appear but an 8-inch disk with APULIB on board. Bliss!

Not having an eight inch drive (it is a System Two, after all), I called my vendor, Condor Computer Corporation. They said they'd be happy to make me a five inch from the eight! I then had in hand everything I needed to finally make the interface (APULIB replaces most of Forlib). Well, not quite. APULIB is a number of separate routines that take the place of identically named software routines in Forlib. This means they must be linked to every program with which you want to use them and, believe me, there are lots of names to type in during the Link process.

Just about the time I was ready to give up, the investment I'd made in joining the Cromemco Software Update Service (SUDS) paid off: a large

Continued Next Page

box arrived from Cromemco which contained all of the new software releases, one of which is LIB. For the uninitiated, LIB is used to make a library of user software; e.g., it combines all of the routines which formerly had to be Linked into one big, serachable user library file. One shot with LIB, and I had my new Forlib.

Forlib (the APULIB version) was put through every pace and test I could think of to test it and assure myself that it did work—and work properly—before I'd let it out of my hands and into the user's. It passed every test with flying colors. It should be noted, however, that there is some (slight) reduction in the dynamic range of single precision numbers by using this firmware/software combination. Redding Group's documentation claims that the magnitude of single precision variables must lie in the range 2.7E-20 to 9.2E18—hardly a limitation in MOST applications. That trade-off is so slight in comparison to the speed increase as to be ignored completely.

For those interested, here's what I bought to accomplish this marvelous magical increase in speed of processing, and approximately what it cost to do it: (1) APULIB, Redding Group, Incorporated, \$350.00; (2) Intel 8231A APU, \$215.00; (3) Compu-Pro System Support 1 Multifunction Board, \$360.00; total price, \$925.00. (A card to support the APU can be had for less, but the System Support 1 card has a number of other features I needed to round out the operation of the computer system.)

Now, some more credit where credit is due. The System Two has bounced from Detroit to Naples twice, and bounced back and forth any number of times between Naples and the Alley with zero failures, and just a few loose IC's. APULIB loaded and worked right the first time, with no fooling around putting patches in to make it go. The System Support 1 board, same thing: everything worked right the first time. I can't give any higher recommendation.

Was it worth it? Undeniably yes—in my circumstances. The number of hours saved in having to do data analysis via telephone lines, the ability

to know immediately after a test whether or not it was any good (before reconfiguring a vehicle for a new test and sending it back out), the potential for further applications: these all make it worth the time and dollars. Adding firmware math to ANY system makes it faster, and I happen to believe that faster is always better; however, how much better is an analysis up to each individual. You've got to look at the cost/benefit ratio to make a rational decision. All computer applications are front-loaded: a great deal more time is spent programming and debugging than you ever spend in actual operation or on the hardware. But, as time goes on, the amount of processor time you use—which translates into an expensive person sitting at a terminal waiting for something to happen—begins to count for more and more. From here on out, I'll be using firmware wherever possible. And now that I know how to use it, any future applications will be a breeze compared to the first one.

It is hoped this little treatise will help somebody else with a similar problem. One thing I found out is that you're pretty much on your own when you attempt to do something that steps a bit off the beaten track. First of all, I got the feeling that most vendors don't really want to talk to you (although I can't really blame them, with all the off-the-wall questions they must get). There aren't a great many sources of "just basic" information concerning how to do a particular thing that needs doing. And finally, the learning curves are pretty steep. If this helps you cut down that learning curve, so much the better. ☐

About the Author

Tom Bonayne has been with America

VENDOR LIST

CompuPro System Support 1
Multifunction Board
Priority One Electronics
9161C Deering Avenue
Chatsworth, CA 91311

Intel 8231A (4MHz version)
various electronics houses

Redding Group, Incorporated
30 Side Cut Road
West Redding, CT 06896

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COBOL CORNER

(.COM files) and set up as a special executable module called "RUNCOB.COM". This common runtime module is loaded at runtime, and is therefore required to be on-line during program loading.

Benefits derived from having a separate runtime module include:

1. Larger programs can be loaded because symbol names are no longer used to resolve local references (symbols beginning with #). This frees symbol table space for more code.
2. REL files are reduced in size for the same reason.
3. REL files are therefore loaded faster by LINK.
4. LINKing is faster because the COBOL Library is smaller and can be searched in one-fourth the time.
5. CHAINing is extremely fast because the runtime system is resident and is not reloaded if chaining to another COBOL program.

I wish I could say the fourth and a very important difference is the inclusion of the SORT verb! regret I cannot! This is a key feature so badly needed as an integral part of COBOL for business application programming.

With the advent of 16-bit processors and expanded memory sizes COBOL, in the near future, will become the "primary" business programming language on micro just as it is today, on the large mainframes.

Any one of the new version 04 60 improvements is well worth by "SUDS" update fee alone—any of the three would be a bargain by itself—but please, Cromemco, don't forget the SORT verb ☐

Enhancements to RATFOR

By Mike Heidling

The latest release of Cromemco RATFOR version 1.05 represents the most comprehensive change in the RATFOR preprocessor since Cromemco's initial release of RATFOR version 1.00 at the end of May 1979. RATFOR version 1.05 compiles almost twice as fast and produces executable code that is 1.5K bytes smaller than the previous version. These two enhancements underscore the latest improvements to RATFOR.

This article has two purposes. The first purpose is to develop a necessary background introduction for those who do not yet program in RATFOR. The second purpose is to describe the cumulative corrections and changes to RATFOR since the first release of version 1.00.

Introduction to RATFOR

A brief background for those not using RATFOR will explain who uses RATFOR and why. RATFOR is an acronym for Rational FORTRAN. As you might expect the RATFOR language includes FORTRAN statements. Actually, all FORTRAN statements are acceptable to RATFOR. That is the **FORMAT** statements, the **DO** statements, the **READ** statements and so forth are all included in the statements which RATFOR can process. Since RATFOR directly uses FORTRAN statements it is easy for FORTRAN programmers to quickly learn and utilize RATFOR. The main motivation for FORTRAN programmers (and any others as well) to learn RATFOR is that it increases programming productivity. The RATFOR preprocessor gives FORTRAN users the ability to use the numerical capabilities of FORTRAN and the logical control of powerful structured constructs such as **FOR** statements, **WHILE** statements, and **REPEAT-UNTIL** statements.

One further advantage of RATFOR is it allows programmers to write FORTRAN-like programs in a free format manner which encourages well indented, readable code.

RATFOR programs compile into executable object code with three simple command statements.

```
RATFOR = program
FORTRAN = program
LINK program,FORLIB/S,program/
N/E
```

The first command gives the RATFOR preprocessor a RATFOR program as input and generates a FORTRAN program as output. The preprocessor will look in the directory for a file called program.rfr and generate as output the file named program.for. All that is necessary is for program.rfr to be resident in the directory. During the next command the FORTRAN compiler compiles the new FORTRAN program into relocatable code. Finally, the Link or Blink linkers link the relocatable code into the executable object code. If these three statements are in a CROMIX operating system command file then the command file acts like a virtual compiler for RATFOR programs.

Enhancements to RATFOR

Surprisingly, very few bugs have been found in RATFOR in the two and a half years since its first release and the ones that have been discovered are very minor. The current version of RATFOR corrects four of the bugs in version 1.00. Two of these corrections involve the **REPEAT-UNTIL** construct. Now **REPEAT-UNTIL** can be nested in either **IF** statements or **REPEAT-UNTIL** statements without the need for enclosing braces. Previously, the **REPEAT-UNTIL** statement when nested in an **IF** statement caused an "illegal else" error message unless

the **REPEAT-UNTIL** statement was enclosed in braces. Likewise, failure to enclose nested **REPEAT-UNTIL** statements in braces generated the "missing left parenthesis" error message. Old RATFOR programs with the enclosing braces will continue to compile normally under RATFOR version 01.05 since the braces are syntactically correct but unnecessary. New programs can be written according to the RATFOR synopsis given in the manual "Software Tools" by B.W. Kernighan and P.J. Plauger, which is supplied with the Cromemco RATFOR package.

RATFOR version 1.00 converted hexadecimal constants, such as x'AB', to Hollerith literals. This no longer happens under the recent version.

Also, RATFOR version 1.00 inserted arbitrary characters into very long format statements which used quoted strings and format descriptors. This no longer occurs.

One characteristic of RATFOR version 1.05 regards RATFOR users who prefer to put their left braces at the end of lines instead of at the beginning of the next line down. These programmers will still find that this practice generates an "unexpected brace" error message for all braces following the keyword **do**. The interim solution is to put the left brace on the line following the keyword **do**. This is not a new problem in RATFOR and is the only remaining problem originally encountered in the version 1.00.

Another characteristic of RATFOR version 1.05 is the permanent restriction against user-defined numeric labels on the same line in front of an **IF**, **DO**, **REPEAT-UNTIL**, **WHILE**, or **FOR** statement. If numeric labels are placed before any of the five mentioned statements

Continued on next page

Enhancements to RATFOR

then RATFOR incorrectly places the label inside of the statement's comment line. The RATFOR preprocessor automatically generates this particular comment line to mark the statement in the FORTRAN output file. When the RATFOR program violates this restriction the FORTRAN compiler later displays the "Undefined Label" error message if the program references the label.

As users are aware, RATFOR version 1.00 converts quoted strings to Hollerith literals. A small change has occurred in the latest version with respect to literals. Now, RATFOR version 1.05 writes quoted strings in the source program directly to the FORTRAN output file virtually unchanged. The only modification to the string is each single quote character in a string delimited by double quote characters is converted to two single quotes. The FORTRAN run time library routines will output one single quote character for each pair of adjacent single quotes. The bottom line is that RATFOR users can now write strings where apostrophes occur in the string in their usual English form. Thus, not only is

"Bob's plane won't arrive at O'Hara until 8 o'clock."

an acceptable literal now, but the final object code will reproduce the sentence exactly as it is written between double quotes.

Another change in RATFOR version 1.05 advances the printed listing to top-of-form after it completes a run.

Error Message Changes

The bane of all programmers is debugging. The more informative compilers, interpreters, and preprocessors are about program errors, the faster programmers can create finished products. The latest release of RATFOR has added 8 error messages, changed 2 error messages, and consolidated 4 error messages into one clear message.

One particularly helpful error message change involves the error message line itself. Now, it displays the name of the source file which has the error and the line number of that file so that errors which are nested inside include files are easier to find. Previously, the error mes-

sage only generated the line number of the include command referencing the nested include file.

A second message change condensed the message which appeared at the end of the RATFOR run which displays total errors.

Among the new error messages the most important one refers to include files. "Cannot open include file" appears when RATFOR cannot find the file named by the include command in the source file's CROMIX operating system directory. Alternatively, when run under CDOS, this message means RATFOR cannot find the file named by the include file on the primary source file's diskette.

If the programmer inaccurately uses the include command this message will appear: "Incorrect format for include filename." The preprocessor will generate this error at any time the program incorrectly uses the include statement. For example, the include command must appear on a line separate from other statements. If not, the statement following the include statement will be confused with the syntax of the include statement. Also, the filename following the include command must be an alphanumeric name with 1 to 8 characters followed optionally by a period and a 1 to 3 character extension. No special characters other than period are allowed. This message replaces four others which read:

"Non-alphabetic name following include"

"No period in filename"

"Non-alphabetic filename extension"

"Filename extension too long"

The preprocessor hung in the past when the definition table overflowed. RATFOR allows a maximum of 200 define statements. Of course, each definition may be one to 200 characters long, but as a rule the definitions do not use the maximum length allowed. In fact the definition table holds a maximum of 1500 characters, so programs may overflow this table if users define too many legal, but long definitions. If overflow occurs, the user will get the "Definition table overflow" error message. The message means the

total number of characters used by define statements exceeds the capacity of the definition table.

A "polite" RATFOR preprocessor will tell the user when it cannot find a RATFOR program file. Unlike version 1.00, version 1.05 will look for the filename on the current drive or directory and "politely" inform the user the "Source file not found" if that is the case.

Conclusion

RATFOR is a friendly FORTRAN, and about any FORTRAN programmer discovers that the time saved in programming pays for the initial costs of the software and time needed to learn RATFOR. Cromemco has a policy of continually improving software products already respected as the best in the industry. RATFOR 1.05 is a good example of the results of that effort. RATFOR 1.05 is faster, more compact, more reliable, more easily used than ever before. Subscribers to RATFOR SUDS (Cromemco's Software Update Service) have already or will soon receive this new version. ☐

About the Author

Mike Hedling joined Cromemco, Inc. in 1981 after receiving a B.A. degree in Computer and Information Science from the University of California at Santa Cruz. He is the RATFOR and FORTRAN product manager at Cromemco, but his responsibilities also include LISP, Data Base Reporter, Data Base Management System, and the Software Diagnostic System. His programming skills include Pascal, C, and Z80 Assembler.

TRW Service Now Available in 31 Metro Areas

The previously announced (Vol. II No. 2) implementation of service programs for Cromemco Systems by TRW Service Techs is now in effect in 31 U.S. metropolitan areas. The initial locations are:

Albuquerque	505/884-3630
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Bridgeport, CN	203/384-0068
Chicago, IL (North)	312/884-0800
Chicago, IL (South)	312/986-6430
Cleveland, OH	216/243-4055
Dallas, TX	214/630-2640
Denver, CO	303/388-6307
Detroit, MI	313/569-4113
Harrisburg, PA	717/761-1997
Houston, TX	713/462-7474
Kansas City, MO	816/753-2578
Los Angeles, CA	213/483-4800

Memphis, TN	901/345-6475
Miami, FL	305/624-0309
Minneapolis, MN	612/484-8319
New York City, NY	212/953-9500
New Jersey Northern	201/379-7300
New Jersey Southern/ (Philadelphia Metro)	609/764-9082
Oklahoma City, OK	405/949-0108
Orlando, FL	305/894-4641
Phoenix, AZ	602/244-9785
Raleigh, NC	919/821-4655
San Diego, CA	714/297-4015
San Francisco, CA	415/352-6557
Seattle, WA	206/641-6660
St. Louis, MO	314/872-9342
Tampa, FL	813/879-1950
Washington, DC	301/459-2070

More than 60 TRW service specialists have completed a technical training course at Cromemco, and more are currently receiving training in the field from TRW training supervisors.

Current Versions of Cromemco Software

Package	Version	Date Master Created
Accounts Payable	02.65	01/11/82
Accounts Receivable	02.65	01/11/82
C Compiler	05.00	03/11/81
CDOS	02.35	10/06/81
General Ledger System	02.65	01/11/82
Inventory System	02.65	01/11/82
SlideMaster	01.05	01/11/82
SpellMaster	01.05	01/11/82
WordMaster	00.46	01/11/82



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Key Personnel: Michael L. Peterson, Systems Analyst
Kathleen Peterson, Office Mgr.
Bruce Hughes, CPA, Acctg. Consultant

Major Market Area: Sales & Service: Orange County
Extended Market Area: Sales & Service: Southern California. Software: Nationwide

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Primary Market Area: Los Angeles Basin
Extended Market Area: Throughout Southern California

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Key Personnel: Taki Oshima, President
John Gibb, Acct. Exec./Graphics
Allaire Turner, System Specialist

Primary Market Area: S.F. Bay Area/Sacramento/Reno
Extended Market Area: Hawaii (Sales, Service & Training)

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Major Market Area:
Sales & Service: Stores in Berkeley, Los Angeles, & Newport Beach, California and Paris, France.

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Key Personnel: Bob Blaisdell, Managing Director
Joy Stone, Sales Coordinator
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Don Walker, Technical Advisor
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Major Market Areas: California, France, Asia. (both sales and service)

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South Melbourne, Victoria, Australia
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Cromemco specialists, providing consulting, sales and service throughout Australia. Staff of eleven includes programmers, analyst and engineers.

Key Personnel: Dr. Simon Rosenbaum, Mng. Dir.
Norman Rosenbaum, Sales Mgr.

Major Market Area: Sales & Service: Throughout Australia

Continued on page 32

bits & bytes, nibbles & tweaks

Ask and Ye Shall Receive

In two previous issues we have asked about the availability of a statistical package to run on Cromemcos. The following letter was received just before press time for this issue.

Editor:

Within a few months, IFDAS, an Interactive Forecasting and Data Analysis System, written in 32K Structured BASIC, will become available. It should meet the needs of several users who are looking for some statistical analysis capabilities on their Cromemco systems.

IFDAS is currently undergoing final code testing and will be market-tested shortly. It occupies about one full, single-sided, double-density 5¼" floppy disk. IFDAS contains multiple regression, summary statistics, curvi-linear regression, scatter plot, and database management facilities. It will operate from a CRT, or hard-copy terminal.

I am particularly interested in the demand for such a package, and would be happy to talk with anyone interested in the subject, as I would like to know the types of statistical capabilities they anticipate needing.

I may be contacted at: 1857 Apple Tree Lane, Mountain View, CA 94040. Phone: (415) 969 4233
Sincerely,
Wayne Watson

Software Swappers?

A good idea was submitted by E. E. Stevens (Raines, Rice & Stevens, Ltd., Auckland, New Zealand) that bears mention, and possibly action.

Editor:

Thank you for publishing our previous request for assistance with Pipe Stressing Programs. Regrettably, we have not yet had any replies.

It has occurred to me that there must be a number of

Cromemco users who, like ourselves, are seeking specialized application programs in a variety of fields. Similarly, there must be Cromemco users who have, or know of, various specialized programs. Could I suggest some form of...exchange of program information? We may all be surprised to learn how many questions and answers there are seeking each other.
Regards,
E.E. Stevens

Like we said, good idea. In fact, if there is enough support for such a program, we will set up a regular department to carry the information. Let's see, would we call it "Software Swappers" or "Parade of Programs" or...? Someone suggest a name. Meanwhile, look through your old program notes and determine what you would be willing to share and/or swap.

Amsterdam Users' Group?

A user in Amsterdam is very interested in making contact with other Cromemco users. If there is not a group in existence now, this could be the start of one. In case you are in the Netherlands and would like to become involved, contact R. van Wezel, Deurloostraat 115 hs., 1078 HX Amsterdam. Telephone (020)761 549.

CP/M Program Re-execution under CDOS

Samuel Guccione of the Terry Campus of Delaware Technical and Community College in Dover, Delaware offered an interesting question:

"In reading about CP/M in S 100 Microsystems, I came across a neat idea that I tried with CDOS. In CP/M, by having a .COM file of zero length, it is possible to re-execute a program without re-loading it. The .COM file causes a jump to the start of the Transient Program Area

(0100H). This .COM is created by typing:

```
SAVE 0 RERUN .COM
```

Executing this .COM file would allow, for example, the re-entering of a BASIC program which had just been loaded without re-loading the BASIC interpreter. After several tries, the following program sort-of works:

```
ORG 100H  
BEGIN: JP 101H  
END BEGIN
```

What I mean by "sort-of" is that it will get me back into the BASIC program, but it prints either:

```
ERROR 124 — (garbage)  
or
```

```
ERROR 254 — (garbage)
```

Neither of these error messages is in my BASIC 5.xx manual. Do any of the I/O News readers have any suggestions on how to implement this idea?"

South Jersey & Philly Group Expands — Renames

The SJ & P Users' Group renamed itself the Microcomputer Users' Group (MUG), and changed its meeting place to larger quarters. It now meets the last Wednesday of each month at King Zog's Restaurant, Ferry Avenue Station, Camden, New Jersey.

The group is now open to users of any type of microcomputers. This exposure of Cromemco hardware to users of other systems has provided a number of converts to Cromemco. For example, at a recent meeting, MUG sponsored an on-site comparison of the Cromemco System One-H, the Northstar HDD5, and the IBM Personal Computer. The Northstar balked at its own HDOS system (but performed satisfactorily under CP/M); the IBM (not S-100 bus) was voted as "looking most impressive on the outside" but that was about all; and the Cromemco System 1-H purred through its performance without a hitch. It was decided by those

Continued on next page

present that, based on price/performance, the Cromemco system was the best buy.

Also surveyed at the meeting were the advantages of CP/M simulated with the SuperCopy program developed and distributed by U.S. Dynamics Corporation. The program was found to be all that it is advertised, and that it runs outstandingly well under both CDOS and CROMIX.

MUG's April meeting will be held aboard a Boeing 747 as 30 members and their families and friends depart for the previously announced "user's meeting" in Hawaii. The week-long event is sold out, but Jim Lenz extends an invitation to all IACU members to attend a cocktail party at Honolulu's Prince Kuhio Hotel on April 25th, if you happen to be in the neighborhood.

For more information on this imaginative group, call (609) 428 6701.

IDS 88-Modem Modification

Sam LaMacchia, in the R&D Department at Cromemco, sent us a relatively simple fix for using the IDS 88-Modem with the Cromemco ZPU.

The problem encountered was corrected by delaying the PWR signal at the modem board. The necessary modifications to the 88 Modem board follow:

Step 1: Locate the trace connecting edge connector (bus) pin 77 and pin 15 of U18. This is the PWR line.

Step 2: Cut the above trace between the plated-through hole and U18.

Step 3: Connect a jumper wire between the plated-through hole (steps 1 & 2) and U32 (74LS32) pin 13.

Step 4: Connect a jumper from pin 12 of U32 to pin 7 of U32.

Step 5: Connect a jumper from pin 11 of U32 to pin 10 of U32.

Step 6: Connect a jumper from pin 9 of U32 to pin 7 of U32.

Step 7: Connect a jumper from pin 8 of U32 to pin 15 of U18.

New York City Users' Group

Charles Perrella is interested in

getting a group started in the Big Apple. Certainly there are a lot of users there who can benefit from some informal meetings and discussions. Interested parties can reach Mr. Perrella by phone at: (212) 354-6383. Or, you can write him at: 7 West 45 St., NYC, NY 10036

Nine SUDS Updates in December

Members constantly call or write us to discover the latest version of a particular piece of software. Starting with this issue, we will list the current versions of all Cromemco software. Just for information, there were nine updates in the month of December, 1981, with more coming each month. Again, we repeat our previous message: if you rely on a certain software package, it is money well spent to subscribe to SUDS. This does not mean you have to adopt each new version if you are happy with the one you are using, but at least you will have the information and the options are yours.

Illinois Users' Group Offers "Show & Tell"

Jim Knowles sent us word of a local users' group that has been meeting the second Tuesday of each month. The group shares experiences through "show & tell" sessions, comparing sources of supplies for software and peripherals, and participating in demonstrations of special software for vertical markets. At their most recent meeting, they saw a package designed for Chiropractic clinics. Other software packages that have been demonstrated include Architectural Woodwork Job Costing, Social Services Accounting, and Auctioneering. If you are in the general area of Elgin, Illinois and would like to attend a meeting, call Jim Knowles or Gordon Muirhead at Synergetics International: (312) 695-7775.

Praise for JVB & Robert Gunn

It is always a pleasure to receive letters such as the following:

Editor:

I would like to pass on to the other members my pleasant experience with the JVB Electronics FDCX4 Double Density upgrade board which allows the 4FDC board to function as a double density disk controller, even when using the PerSci 277 drives. My 277s have performed well using double density in both CDOS and CROMIX. It's nice not to have to discard either the top-notch 4FDC board or PerSci 277 drives when switching to double density, which is at least 4X nicer than single.

I continue to be impressed with Bob Gunn's enhancements to CROMIX. He has a really nice group of utilities which integrate well with CROMIX to simulate UNIX even more. Gunn's CDOS and CROMIX versions of WordStar are excellent and fit beautifully with the operating systems. Also an excellent CPM simulator is available as well as the SuperCopy program.

Finally, I am anxious to form a Cromemco Users' Club in the Sacramento (California) area. Anyone interested can call me evenings at (916) 791-1540. Thanks for the space. Regards, Clinton Pace, M.D.

St. Louis Group Welcomes Charter Members

There is still time to get in on the ground floor of a local group being formed in the Greater St. Louis area, according to organizer John Knapp. Encompassing not only the St. Louis area, but Central Illinois, this group's doors are open to all Cromemco users from fledglings to "phreaks" and everyone in between. For more information, call John Knapp at (618) 624 2727. **CD**

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typing the line "term 2" or "term 3" from any other operational terminal will bring on the quiet terminal. We use separate tty tables for each terminal so that processing by users on other terminals will not be disrupted. The command file looks like this:

```
RENAME /ETC/TTYS /ETC/TTYS123
RENAME /ETC/TTYS.#1 /ETC/TTYS
KILL - 1 1
RENAME /ETC/TTYS /ETC/TTYS.#1
RENAME /ETC/TTYS123 /ETC/TTYS
KILL - 1 1
```

The # sign in the above command line is used to accept the appropriate tty number. We found that a simple kill command did not bring on a terminal unless a change had occurred in the tty table itself. That is why we temporarily "swap" tty tables. It works fast and does not affect others in the system.

Bringing up Other Terminals

One thing we noticed on our own CROMIX system when we went to version 11 of CROMIX was that terminals in the system would not come up unless they were powered up when the system was booted. We were accustomed to turning on the extra terminals only when needed and seeing the login message at that time. Under version 11 nothing happens unless the CRT is on when the system is booted.

Mike Hazen, our systems analyst, came up with a simple command file arrangement to bring on line "quiet" terminals. It works well and saves having to re-boot the system to bring on the terminals.

Basically we have a cmd file that renames the /etc/ttys to a temporary file called /etc/ttys.123 (for ttys 1, 2, and 3). Then it renames a temporary tty table to /etc/ttys and executes the kill - 1 1 command. The temporary tty table used depends on the terminal you want to bring on line. We have a different one for every terminal in the system except ttyl which obviously is on because it is used to bring up the system. Then,

Serial Printers in CROMIX

We had some problems using a simple serial printer in CROMIX. When I say simple I mean one that requires no handshaking of any type. The easiest solution was to tie it to an unused tty port on one of the TUARTs and do a maklink to that tty and the prt in the /dev directory. This was often done with version 10 of CROMIX and was a simple way around the complexities of the serial drivers provided with version 10.


Termination Resistor Packs

There has been some confusion about termination resistors on various system configurations. This is especially important when you are dealing with a system that has had added-on disk drives, 5" or 8", or added hard disk drives. The termination resistor packs are for the last physical drive on the ribbon connector cable. All other resistor packs should be removed. In the case of all drives, the termination resistor is on the component side of the PC board next to the ribbon cable connector. On 5" drives it is in IC socket 1E. On 8" drives it is in socket U8. On the IMI

hard disk drives, they are in the two IC sockets on the end of the mother board near the power connector. In the case of an HDD-22 be certain that the resistors are in the last drive, that being the one connected to the bottom set of connectors on the HDD cabinet for future drive expansion. If another hard disk drive is added later, remove the resistors on the first drives.

I have seen improperly installed resistors cause everything from occasional CRC errors to stopping drives all together.

Using Special Printer Features

Most dot matrix printers have the ability to go to expanded print, compressed print, graphics modes, etc. In addition fully formed letter printers can change spacing for 10 pitch, 12 pitch or many options in between. It was always a hassle to change the settings on the printer so I put the necessary command strings, usually escape or control character sequences, in files in the /etc directory. For instance, a form feed on our printer is a CNTL F. Therefore I typed the line "echo . /etc/formfeed "CF"" to place a control F in a file named "formfeed" in the etc directory. Then I created a command file in the /cmd directory that did the following "type . /dev/prt /etc/formfeed". The CNTL F was sent to the printer and a form feed is the result. At any time I want, I can type "formfeed" from any directory and the printer responds. We have done this with a command file named "10pitch" and one named "12pitch" so that we can change our 3355 printer from 10 pitch thimbles to 12 pitch thimbles and reset the spacing of the printer for large or small print. You could use this to set up command files to clear the screen on the terminal or any one of dozens of things. I think that the command file capabilities in CROMIX are without a doubt one of the most powerful features of CROMIX. We use these often. 

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David Bryan, Sr. Systems Analyst

Major Market Area: Software — Nationwide
Hardware — Northern California

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Major Market Area:

Sales: San Francisco Peninsula & Nevada extending internationally.

Service: S.F. Peninsula & Nevada extending into N California

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Major Market Area: Texas, Southwest, Mexico, Middle East

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Extended Market Area: Service and Software: U.S. and Canada

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Kevin Elmore, Programmer/analysis

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Service: S.W. Kansas

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Service: Metro Philadelphia extending to Eastern Corridor.

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Key Personnel: Coley Brown, President

Primary Market Area: Hardware Sales & Service — New Jersey & Southern New York State. Software Licensing & Service — U.S., Canada & Mexico.

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Major Market Area: Southeast Florida

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Major Market Area
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A Universal Microcomputer Local Area Network

Continued from Page 9

The most flexible configuration is the bus network, where all nodes are connected along a central bus much like different branches off of a central tree trunk. This type of geometry offers the maximum flexibility in installing a Local Area Network, as the central bus can be run throughout an office or factory, and taps can be installed as necessary for remote stations.

To illustrate why a bus network is considered preferable, a typical network application is shown in Figure 2.

terms of compatibility with other systems and the ability to be rapidly checked for errors. Similarly, the addressing format is not critical except for the requirement that each node be individually addressable or capable of being selected en masse for group broadcasts.

A more critical problem is collision avoidance, or making sure that no more than one node is transmitting at any given time. If a collision takes place, there are two methods of reacting: the data link layer could either provide for a random delay at

received. The error detecting code itself can either be a simple good/bad data check, or it can contain enough information to reconstruct the erroneous data. Of course, the longer the error correcting code, the longer the transmitted message will be.

Transmission rates in use in Local Area Networks range from under 1000 bits per second to 50 million bits per second. The constraining factors on data rates are the cost of hardware at each node and type of transmission medium. The func-

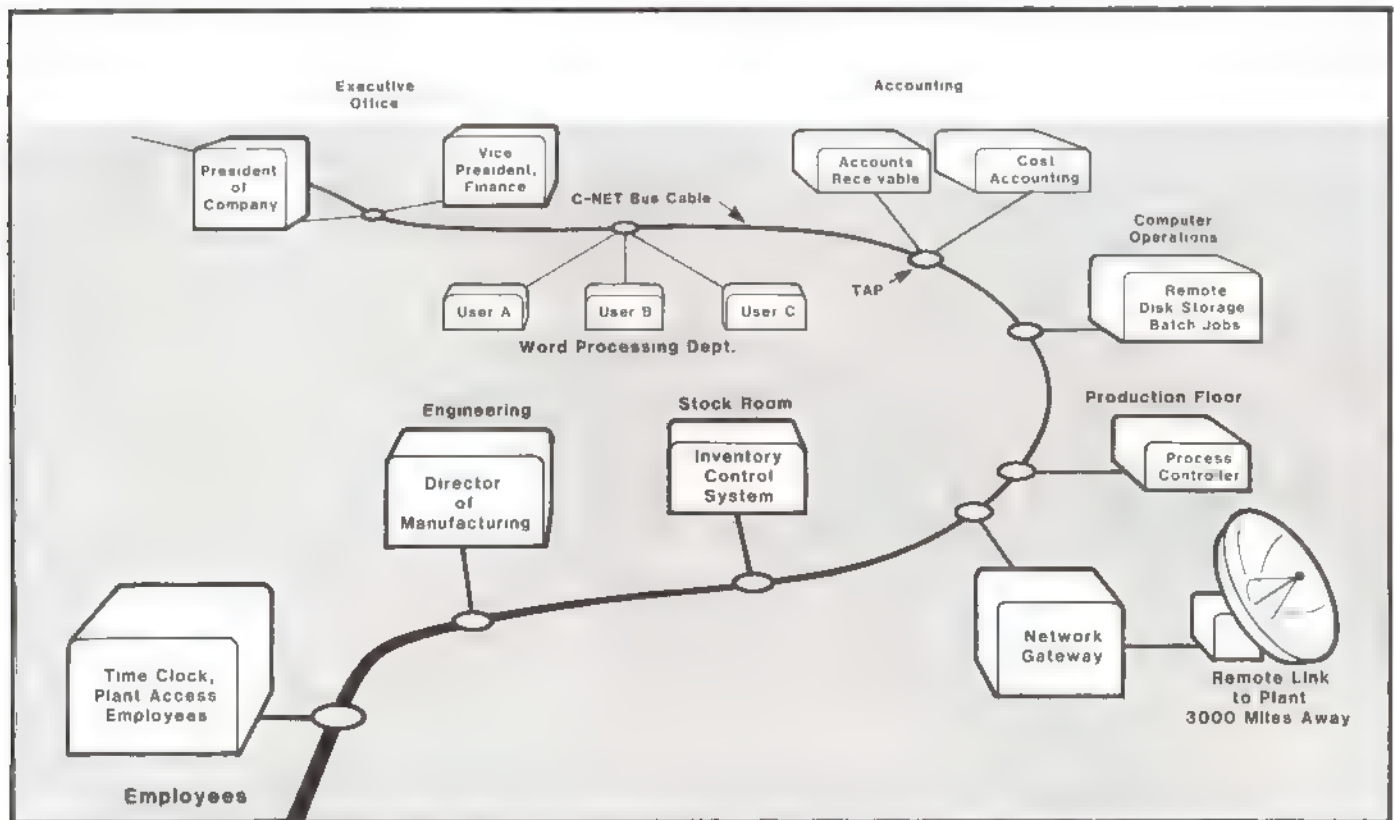


Figure 2.

How Networking Operates

A data link layer handles the network protocol: basically the form in which the data is arranged, and who gets to talk to whom at what time. The data from each remote node is arranged into a packet consisting of (roughly) an address or destination code, the data to be transmitted, and an error correction code that enables the receiver to check the data received for possible transmission errors.

The format in which the data is transmitted is not critical except in

each transmitting node (the so-called cocktail party conversation effect); or there could be a "token" which is passed from node to node which identifies the transmitting node at any given instant. The token concept slows the system, but ensures that no node will ever be forced to constantly delay transmission because of constant collisions.

Error correction systems can take two forms: either only the good packets will be delivered; or the transmitter can rebroadcast the packets as many times as necessary to ensure that all packets will be

tional factors of concern in setting a system data rate are the type of processor being linked, the expected number of users on the system, and the amount of data each user will be transmitting over the network. For a network supporting a few hundred microprocessor based systems, a data rate between 100 thousand and one million bits per second should be quite adequate.

The transmission medium itself is dependent on the desired data transmission rate and the tolerable cost of the cable as a fraction of the

Continued Next Page

total system cost. Commonly used cables include multiconductor bus cables, twisted pair, broadband coaxial cable, and Cable TV quality coaxial cable. Non-cable type transmission media include infrared links, VHF or UHF radio links, and satellite path links. Possibilities for lower data rate transmission include power lines and existing telephone lines. The advantage of the latter two types of media is the fact that both are commonly found in existing office facilities, eliminating the requirement for installation of a new cable system.

Applications Criteria

The varied applications of Local Area Networks present a set of problems which existing networks do not overcome. There are four main areas in which existing Local Area Networks exhibit shortcomings: cost, reliability, durability, and flexibility. Cost is of primary importance, especially when the cost of computing power is dropping so rapidly. It is not very cost effective to spend five thousand dollars to attach a one thousand dollar terminal to a Local Area Network. The cost of the network hardware must be realistic in relation to the cost of the network work stations.

Reliability and durability go hand in hand with respect to network requirements. A network must be dependable and available if it is to be a useful tool in increasing productivity in a business environment, or if it is to be a valuable tool in an educational environment. Simplicity in network design is to be encouraged, but not to a point where the reliability of the network is threatened. For example, a common shortcoming of many inexpensive schemes is the use of unshielded cable as the network transmission medium. While this does contribute to the low cost of the system, it introduces problems in a hostile environment where the system may be susceptible to noise bursts or lightning induced interference.

Similarly, lack of error detection or data security is another shortcoming of some Local Area Networks.

Finally, flexibility is a requirement in that the network must be able to support a large number of different

types of computers or computer-controlled devices which may be connected to the network. A system which is not tied to the equipment of any one vendor is desirable. In addition, the network should be flexible enough to support interfaces to either other levels of data networks, or to other communications media such as microwave or satellite links.

Introducing C-NET

As a solution to the problem of providing a Local Area Network which meets the above requirements, Cromemco proposes the C-NET standard for microcomputer Local Area Networks. The C-NET standard will provide a cost effective, flexible, reliable, and durable network for linking office, factory, or general purpose microcomputer equipment together, as well as being expandable to higher levels of network communication.

One of the key features of the C-NET is the rugged nature of its design. The physical link and network interface is based on Military Standard 1553B, a standard for military aircraft internal data busses. A low-cost (20 cents/foot) twin-ax cable provides the reliability of a twisted pair inside of a heavy braid, which provides superior shielding of stray noise in a factory setting.

Coupling to the transmission cable is done through transformers so that the network electronics is completely isolated from the physical link at all times. This provides two forms of protection: first, the network electronics is immune to faults in the network cable, such as induced noise transients or electrical shorts; secondly, the network is physically isolated from each individual node. Thus, if any one node should fail, there is no possibility of the entire network being affected.

The C-NET hardware uses a differential transmitter and receiver to reject common node noise; a phase locked loop for clock recovery minimizes noise sensitivity. LSI circuits perform the bit protocol in each network interface card, along with error checking, collision avoidance, and address decoding.

Each C-NET cable segment (the hardware itself) supports up to 255 users, however the C-NET protocol (software) is expandable up to six

bytes of software decoded addresses for a maximum of 2.8×10^{14} (280 trillion) individually addressable users.

The data rate of the C-NET was chosen to be 500 kBits/second, a realistic maximum to allow interfacing between various types of user equipment. The standard C-NET cable can allow cable lengths in excess of 2000 meters between nodes. Special low loss RG-22 twin-ax cable can be used for lengths as long as several miles.

Functions capable of being implemented in the network control software include electronic mail storage and delivery, error logging, data compression, and data security. The electronic mail program is a post office simulator that not only delivers electronic mail, but also holds mail for users who are not logged onto the network. Error logging is part of a general housekeeping function that allows the system planner to keep tabs on system utilization, needs for future expansion, and particular nodes which are error prone and thus need preventive maintenance. Data compression programs allow more efficient use of the data transmission bandwidth available on the network.

Data security is possible through a split-level philosophy. In addition to the high security of the physical link and associated error detecting codes, additional data security can be provided by using the national DES code to encrypt transmitted data. This is particularly desirable when sensitive information not intended for general consumption is transmitted over the network.

Continued Next Page

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ISO-ANSI Reference Model		C-NET Standard
Application Layer	}	HOST Computer Software
Presentation Layer		
Session Layer		
Transport Layer		Software Service for C-NET Interface
Network Layer		Input-Output Processor Z-80
Data-Link Layer		Serial Input-Output Controller Z-80SIO
Physical Layer		Differential Transceiver and Twin-Ax Cable

Figure 3. A Comparison Of The C-Net Standard And The ISO-ANSI Reference Model For Open System Interconnection

Continued from Page 37

C-NET Architecture & Hardware

The architecture of the C-NET system is parallel to the bottom four layers of the International Standards Organization and American National Standards Institute's Reference Model of Open Systems Interconnection, as shown in Figure 3.

The C-NET implements the physical link layer, or twin-ax cable; the Data Link through a Serial Input-Output controller; the Network layer through a special Input-Output Processor; and the transport layer

through software service to the Host computer.

The hardware implementation of the C-NET interface is based on the industry standard Z 80A microprocessor for system control and the Z 80 SIO chip which performs the SDLC bit protocol selection and data transfer. The Z-80 CTC (Control Timer Chip) is used as a control and interrupt timer for the data transfer process. 16 Kbytes of onboard RAM and 32 Kbytes of ROM are included

to hold the network servicing software and message buffer space. Figure 4 is a block diagram of the C-NET hardware interface. In order to promote broad use of the design, no custom integrated circuits are required. (For more details on other Cromemco satellite processors such as the IOP, see Curt Terwilliger's article "The C-BUS, IOP, and QUADART" in I/O NEWS, Volume I, Number 2.)

Continued Next Page

Data Transmission

The standard data rate of the C-NET interface is 500 kBits/second. A crystal controlled transmitter clock is locked to this frequency, which was chosen as a standard capable of allowing all types of microcomputer-based machines to be interfaced to the C-NET. The C-NET interface hardware itself offers the user the option of selecting any data transmission rate from audio to 880 kBits/second. For example, a user using only high speed microcomputers might choose an 800 kBit/

second data rate while another user interested in linking networks over a cable television distribution system might choose a data rate appropriate to that system.

A standard header is added to each data group by the C-NET interface. The header is nineteen bytes long, and is composed of six bytes of destination address, six bytes of source address, two bytes describing the type of packet to follow (mail, file data, etc.), two bytes of subuser identification if multiple users are connected to one node, one

byte of software error checking, and two bytes which give the length of the information following in the packet. After converting the data to SDLC format, the Z-80 SIO adds a start flag, an end flag, and sixteen bits of Cyclic Redundancy Check error detection code. The maximum length of the packet information is 1500 bytes, which is limited by the optimum effectiveness of the CRC error detecting code. Figure 5 is a representation of the format of a packet for transmission on the C-NET.

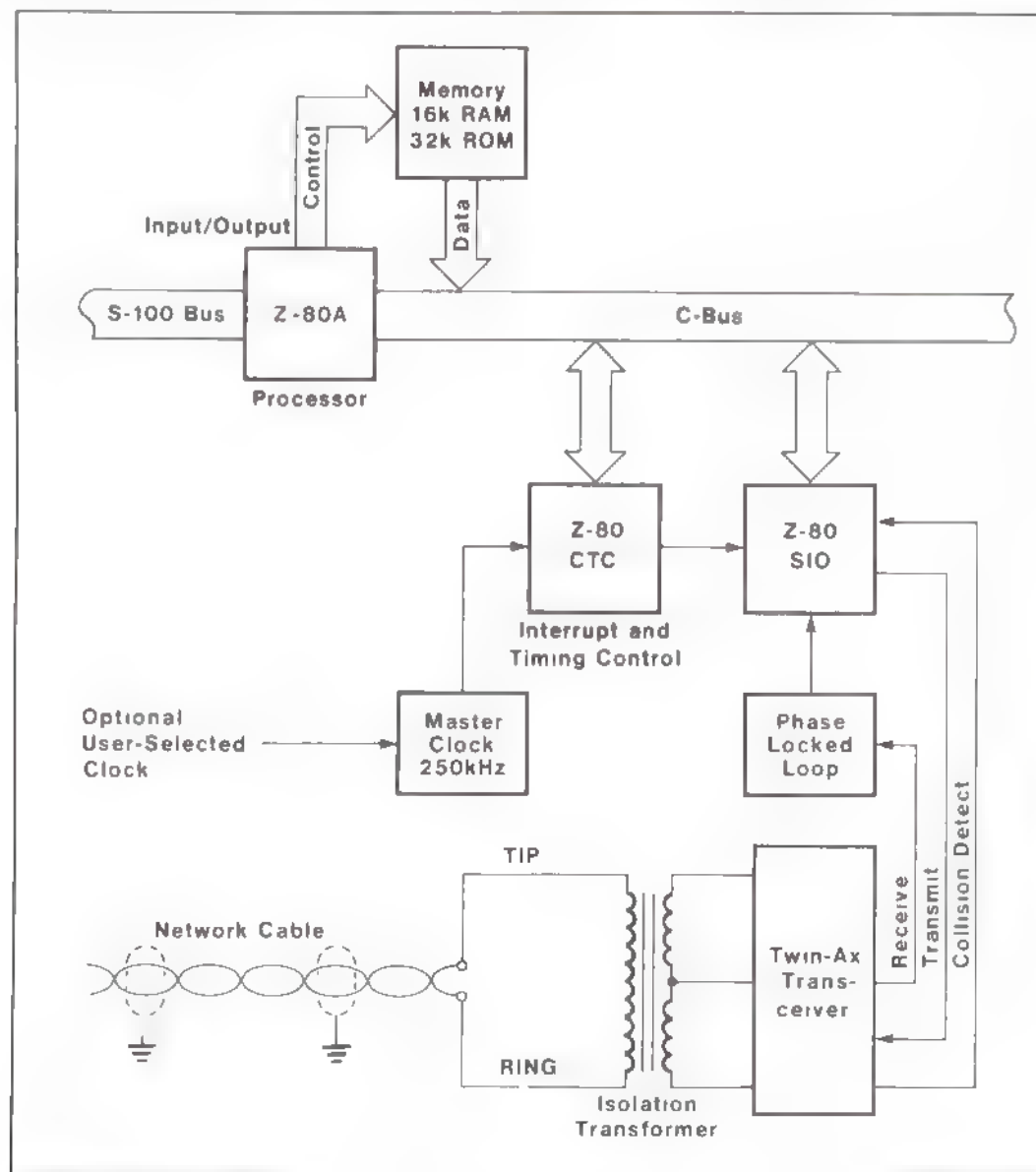


Figure 4. Block Diagram Of The C-NET Interface Hardware Based On Standard Z-80 Components

Continued Next Page

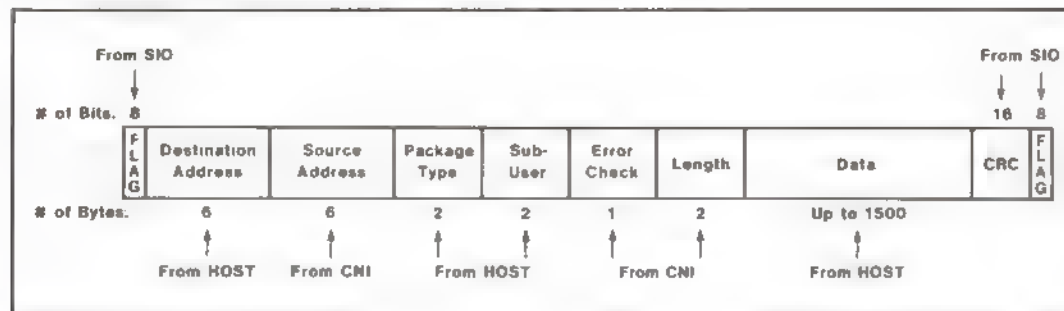


Figure 5. The C-NET And Header Protocol, Showing The Origin Of Transmitted Data

Protocol Principles

C-NET network protocol is based on two principles: carrier sense and collision detection. Before transmitting a message, the originator monitors the network to see if the cable is idle. If no other carriers are detected, transmission of the packet begins. While the originator is transmitting the packet, it is also listening for collisions with other stations on the net. Ordinarily, there is no chance of another station breaking into the middle of a transmission. The only possible collision that might occur is if two stations listen to an idle network at the same time and then simultaneously begin transmitting. If a collision is detected, the contention may be resolved in one of several ways. The network user would be able to select the following options based on the amount of traffic and contention present on the net: the network control software could resolve contentions by selecting random time-out delays for each transmitting station; a second alternative would be to switch to a token-passing protocol, where authorization to transmit is passed to each station in turn. This would ensure that each station on the network would be given an opportunity to transmit, at the cost of decreasing the network throughput.

After a message is transmitted, the receiving station must send an acknowledgement to the originator. If no acknowledgement is heard within a set time, or if a negative acknowledgement is received (indicating a transmission error), the message is re-transmitted by the originator until a proper receipt acknowledgement is received.

The C-NET network topology is based on the single bus cable, rather than the cluster or ring configurations mentioned earlier. This ar-

range simplifies the installation of the network and allows for maximum flexibility in system design. Taps connect user workstations to the main bus much like branches growing from a tree trunk. An advantage of the C-NET protocol is that it allows each tap to be used either by a multi-tasking, interrupt driven, multi-user computer operating system such as CROMIX, or by multiple CDOS-based systems. This allows the cost of each network tap to be distributed over many users. Gateways will allow several main cables to be linked to form a "super" local network.

Data Transmission Circuits

There are two traditional methods in which data is transmitted between nodes, or users, on a network system. The first method is the datagram, which is similar to a telegram in that a one-way transmission of information is sent by an originator who does not receive an immediate answer. The second transmission method is called a virtual circuit, because it resembles a physical link between two network nodes. This allows a prolonged two-way exchange between two network users. The C-NET forms a virtual circuit between nodes on the network. A virtual circuit is more rigid than a datagram or one-way packet because two-way data communications are possible between nodes. Yet at the same time, it is possible to avoid collisions and contentions on the network and allow for priority transmissions. It is felt that the virtual circuit overcomes the short-comings of datagrams while retaining the advantages of collision and contention avoidance.

The cable type chosen for use in the C-NET is similar to Belden type

9272, a twisted pair shielded coaxial cable. This type of cable has a 78 ohm nominal impedance and an attenuation of 0.6 dB/100 feet at 1MHz. The cable is driven through an isolation transformer by a differential transmitter/receiver. In addition to providing superior common-mode noise rejection, the driver circuit also provides complete isolation between the network cable and the interface hardware. In most networks, failure of one node can load down the entire network and require that the system be shut down. In the C-NET, the added isolation means that any node hardware failure will not affect the rest of the network. The network hardware is also resistant to damage caused by lightning-induced currents or noise bursts caused by heavy machinery in a factory environment. The induced signal common mode noise rejection ratio of the C-NET link is greater than 60 dB. The C-NET cable is also considerably less expensive than a custom design coaxial cable, yielding a cost savings of ten to one as compared to cable presently used in the XEROX ETHERNET system.

In addition to data transmissions, the C-NET circuits are configured so that in the future voice and video transmission can be added to the network. Two frequency bands are reserved in the C-NET system: under 10kHz for voice messages, and frequencies over 1MHz for modulated multichannel video, audio, and data transmission. The broadband nature of the cable chosen for the C-NET transmission medium allows those users interested in voice and video networking in addition to data nets, to add those features easily.

Continued Next Page


Offered as an Industry Standard

Other provisions of the C-NET include the capability of linking multiple C-NETS together; gateways to networks such as ETHERNET, WANGNET, or national X.25 networks; and the possibility of links to satellite ground stations for long dis-

tance high speed data communications.

By avoiding sole source custom integrated circuits and expensive high speed circuitry, the cost of a basic C-NET system has been kept very low, and may be implemented by others. At the same time, the sys-

tem is very flexible and can be expanded to meet expanding user requirements.

The proposed C-NET standard for a universal microcomputer Local Area Network is a cost effective means of standardizing the interconnection of a wide variety of computer-based machines, ranging from word processors to automated machine tools. Through industry-wide standards, Local Area Network equipped computer products will eliminate many of the compatibility and obsolescence-related concerns of potential users. The C-NET is a flexible, durable, and reliable network protocol which Cromemco believes will provide a stable base for developing and expanding the users of Local Area Networks for small computers. 

ETHERNET vs. C-NET: How they compare...

While C-NET was developed as a microcomputer Local Area Network standard, there are several features that make it attractive as an alternative to the XEROX-DEC-INTEL proposed ETHERNET standard. While offering a slower data transfer rate than ETHERNET, the C-NET has a much more rugged physical link which would be of particular interest to end users faced with a hostile environment, such as a factory with high electrical noise levels. To quote from the INTEL local network specification, "Electrical noise in the environment can cause transient interference on the transmission medium and in the network interface components. Different media and transmission techniques offer various degrees of immunity from this noise. For example, using shielded twisted pair cable with differential drivers

generally offers less susceptibility to most externally-induced interference than a coax cable with an unbalanced driver."

Both C-NET and ETHERNET use similar and compatible specifications for the data link layer. Thus, any higher level software written for one network could be easily adapted to the other. Hardware interfaces between the two networks should also be easily accomplished.

Another consideration is whether the higher data rate of the ETHERNET standard is worth the higher cost of the hardware. There is no obvious answer to this question. It must be left to each user to decide which system best meets the overall system requirements. The following table summarizes the similarities and differences between the two networks.

SPECIFICATION	ETHERNET	C-NET
Maximum Data Rate	10M bits/second	880K bits/second
Network Topology	Bus	Bus
Max. Station Separation	500 m.	2000 m.
Max. Number of Stations	1024	255 per cable segment
Physical Medium	coaxial cable	shielded twisted pair
Driver type	unbalanced	differential
Max. # of data bytes/packet	1500	1500
Minimum # of data bytes/packet	46	no minimum
Approximate Cost per node	\$6000.	\$1000.
Collision/Contention detection	yes	yes
CRC error detection	yes	yes
High Noise Rejection	no	yes
Isolated medium	no	yes
Uses standard cable	no	yes



About the Author

David Mandelkern received the B.S. degree with distinction and the M.S. degree in Electrical Engineering from Stanford University, Stanford, California in 1981. In 1980-81, he was a Research Assistant in the Integrated Circuits Lab, Stanford Electronics Laboratories, working on high voltage capacitive drivers for use in a reading aid for the blind.

In September 1981, he joined the staff of Cromemco, Inc., Mountain View, California, as a Research and Development Planner. In addition to strategic planning, he has been involved in the product development and introduction of the Cromemco C-NET Local Area Network, and the advanced 16/32 bit supermicro computer family of products. Mandelkern is a member of Sigma Xi and the IEEE.

Implementation of Hardware Clock/Calendar Board

Read Time Routine

This simple program will read the time of day.

```

10 C1 = 250:C2 = 249
20 DIM T(6*1)
30 OUT C2,16
40 I = 0
50 FOR D = 37 TO 32 STEP -1
60 OUT C1,D
70 T(I) = INP(C1)
80 I = I + 1
90 NEXT D
100 B = T(0)
110 IF B > 7 THEN P$ = " "
120 IF T(0) > 7 THEN T(0) = T(0) - 8
130 IF B < 8 AND T(0) > 3 THEN P$ = "PM"
140 IF B < 8 AND T(0) < 4 THEN P$ = "AM"
150 IF T(0) > 3 THEN T(0) = T(0) - 4
160 @ "THE TIME IS ";T(0);T(1);":";T(2);T(3);":";T(4);T(5);" ";P$
170 OUT C2,0
180 END

```

TEST RUN OF TIME ROUTINE:

```

>>RUN
THE TIME IS 06:51:29 PM
... 180 ...

```

Date Routine

The following is a simple routine to read the date.

```

10 C1 = 250:C2 = 249
20 DIM T(7*1)
30 OUT C2,16
40 I = 0
50 FOR D = 44 TO 38 STEP -1
60 OUT C1,D
70 T(I) = INP(C1)
80 I = I + 1
90 NEXT D
100 IF T(4) > 3 THEN T(4) = T(4) - 4
110 @ "THE DATE IS ";T(2);T(3);"/";T(4);T(5);"/";T(0);T(1)
120 B = T(6)
130 B = B + 1
140 ON B GOTO 180,190,200,210,220,230,240
150 @ "TODAY IS ";W$
160 OUT C2,0
170 END
180 W$ = "SUNDAY":GOTO 150
190 W$ = "MONDAY":GOTO 150
200 W$ = "TUESDAY":GOTO 150
210 W$ = "WEDNESDAY":GOTO 150
220 W$ = "THURSDAY":GOTO 150
230 W$ = "FRIDAY":GOTO 150
240 W$ = "SATURDAY":GOTO 150

```

TEST RUN OF DAY ROUTINE

```

>>RUN
THE DATE IS 08/02/81
TODAY IS SUNDAY
... 170 ...

```

As with any hardware clock/calendar system, a programmer can rewrite the clock drivers in the operating system (CDOS) and cause CDOS to interact with the basic program. But this will require a well-rounded knowledge of conditional assembly language programming.

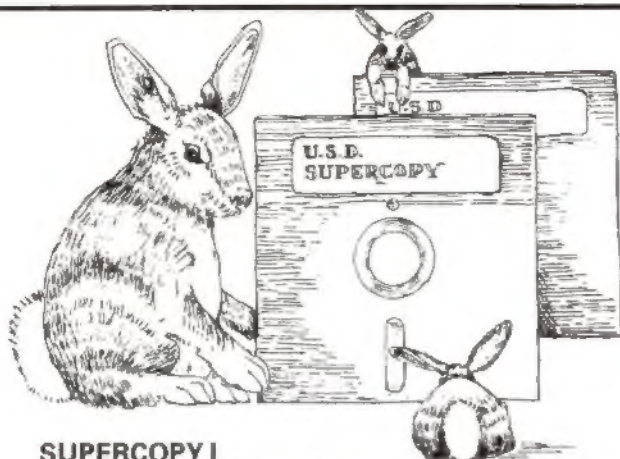
I will be happy to make any assembly language source program available to IACU members for a copying and handling charge of \$15.00 (U.S. currency only please). Send your requests to:

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CD

About the Author

Michael Turnage is the president of Turnage & Turnage, Ltd., a software development company in Long Beach, California. He has been programming in BASIC for seven years. His hands-on experience includes such computers as Data General, IBM 34/38, Hewlett Packard, and, of course, Cromemco. Some of the custom software packages developed by Turnage & Turnage are Data Base, Mailing List, Independent Trucker, Financial, Income Tax, and Engineering Utility.



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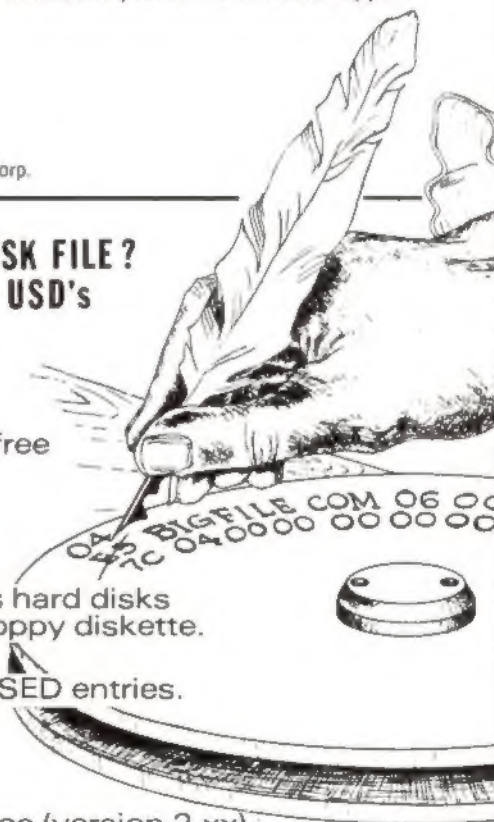
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FILE SYSTEM

One of the important features of our CROMIX is its file system comprised of hierarchical directories. It's a tree structure of three types of files: data files,

directories, and device files. File, device, and interprocess I/O are compatible among these file types (input and output may be redirected interchangeably from and to any source or destination).

The tree structure allows different directories to be maintained for different users or functions with no chance of conflict.

PROTECTED FILES

Because of the hierarchical structure of the file system, CROMIX maintains separate ownership of every file and directory. All files can thus be protected from access by other users of the system. In fact, each file is protected by **four separate access privileges** in each of the three user categories.

TREMENDOUS ADDRESS SPACE, FAST ACCESS

The flexible file system and generalized disk structure of CROMIX give a disk address space in excess of one gigabyte per volume — file size is limited only by available disk capacity.

Speed of access to disk files has also been optimized. Average access speeds far surpass any yet implemented on microcomputers.

'C' COMPILER AVAILABLE, TOO

Cromemco offers a wide range of languages that operate under CROMIX. These include a high-level command process language and extensive subsystem support such as COBOL, FORTRAN IV, RATFOR, LISP, and 32K and 16K BASICS.

There is even our highly-acclaimed 'C' compiler which allows a programmer fingertip access to CROMIX system calls.

THE STANDARD O-S FOR THE FUTURE

The power and breadth of its features make CROMIX the standard for the next generation of microcomputer operating systems.

And yet it is available for a surprisingly low \$595.

The thing to do is to get all this capability working for you now. Get in touch with your Cromemco rep today.

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†UNIX is a trademark of Bell Telephone Laboratories



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